PB87-183802

Superfund Record of Decision (EPA Region 1)
Industri-Plex, Woburn, Massachusetts
September, 1986

(U.S.) Environmental Protection Agency
Washington, DC

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16. ABSTRACT

The Industri-plex site is a 245-acre industrial park located in Woburn, Massachusetts. Various manufacturing facilities operated on the site from 1853 to 1968. During these years the site has supported manufacturers of sulfuric acid (and related chemicals), animal hide glue, arsenic insecticides, acetic acid, dry colors and munitions; and producers of organic chemicals including phenol, benzene and toluenes. Prior to 1934, waste materials appear to have been randomly disposed of over a wide area. The wastes were used to fill lowlands, wetlands and shallow ponds, and as construction material to build dikes and levees to contain liquid wastes. After 1934 wastes were deposited directly on top of the existing deposits and reached heights in excess of forty feet above natural grade. The presence of hazardous substances was detected in 1979 when the current owner of the site, Mark Phillip Trust, began developing portions of the site. As site development began to encroach on the buried animal glue manufacturing wastes, a very strong and pervasive "rotten egg" odor was released. Despite repeated citizen complaints and notices of violations issued by the MDQE, the Trust continued its development of the site. Portions of stockpiled wastes sloughed off, releasing hydrogen sulfide gases to the atmosphere and toxic metals and soils to the pond and wetlands. Large areas of the contaminated soils are exposed at the surface thereby allowing individuals and animals to come in direct contact with
(See Attached Sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision Industri-plex, MA Contaminated Media: soil, sludge, gw, air Key contaminants: VOCs, heavy metals, toluene, benzene		

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Superfund Record of Decision:

Industri-plex, MA

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238P

16. ABSTRACT (continued)

arsenic, chromium and lead. Other contaminants of concern include benzene and toluene.

The selected remedial alternative for this site includes the following actions. For contaminated soils and sludges: site grading; installation of a permeable soil cover cap over certain areas; implementation of institutional controls; water quality monitoring; and post closure maintenance consistent with RCRA regulations. For ground water: an interim remedy of pumping "hot spot" areas and ground water treatment to control odors, air stripping to remove VOCs and discharge to the upgradient portion of the aquifer; and ground water monitoring. For air: stabilization of the side slopes of the East and West Hide Piles; installation of a gas collection layer; installation of a synthetic membrane cap to establish impermeability; and treatment of gaseous emissions with either activated carbon or thermal oxidation with the final treatment selection to be decided after the impermeable cover has been installed; implementation of air quality monitoring program; and routine maintenance. The estimated capital cost for the entire remedial action is $12,302,300 or $12,612,000 depending on air treatment with annual O&M of $285,500 or $311,000 depending on air treatment.

Record of Decision
Remedial Alternative Selection

SITE: Industri-plex
Woburn, Massachusetts

DOCUMENTS REVIEWED

I am basing my decision primarily on the following documents describing the analysis of cost-effectiveness of remedial alternatives for the Industri-plex Site:

- Plan for Investigation of Hazardous Waste Problems: Woburn, Massachusetts, Fred C. Hart Associates, Inc., March 1980.
- Monitoring of Metal Content in Airborne Particulates Migrating From Mark Phillip Trust, Ecology and Environment, Inc., TDD No. F1-8005-01B, December 29, 1980.
- Amendment to the North Woburn, Massachusetts Monitoring of Metal Content in Airborne Particulates, Ecology and Environment, Inc., TDD No. F1-8104-05, May 13, 1981.
- Inventory and Analysis of Existing Well Data for East and North Woburn, Massachusetts, Ecology and Environment, Inc., TDD No. F1-8010-03, January 9, 1981.
- Interim Report on The Geology and Groundwater of North and East Woburn, Massachusetts, Ecology and Environment, Inc., TDD No. F1-8010-02A and F1-8010-03A, April 3, 1981.
- Evaluation of the Hydrogeology and Groundwater Quality of East and North Woburn, Massachusetts, Final Report, Ecology and Environment, Inc., TDD No. F1-8109-02, June 25, 1982.
- Woburn Environmental Studies Phase I Report Volume 1-3, Environmental Assessment, Stauffer Chemical Company, April 1983.
- Woburn Environmental Studies Phase II Report Volume 1, Remedial Investigation, Stauffer Chemical Company, August 1984.
- Woburn Environmental Studies Phase II Report Volume 2 Feasibility Study, Volume 3 Appendices 1-8, Stauffer Chemical Company, April 1985.
- Safe Levels of Arsenic, Chromium and Lead in Soils at the Woburn Industri-plex 128 Site, Woburn, MA, Environmental Research & Technology, Inc., Document No. D242-001, July 1985.
- Technical Comments Document for the Woburn Industri-plex 128 Site Feasibility Study, Woburn, MASS, Environmental Research & Technology, Inc., Document No. D242-002, July 1985.

- Floodplain and Wetland Assessment, Woburn Industri-plex 128 Superfund Site, Woburn, Massachusetts, Volume I, Roux Associates, Inc. and Wetland Management Specialists, Inc., July 1986.
- Volume II Wetlands Assessment Woburn Industri-plex 128 Superfund Site, Woburn, Massachusetts, Wetland Management Specialists, Inc., July 1986.
- Woburn Environmental Studies, Supplemental Report to Flood Plain and Wetlands Assessment Study Submitted July, 1986, Stauffer Chemical Company and Roux Associates, August 28, 1986.
- Industri-plex Technical Review of Roux Associate's Groundwater Discussion Near the East Hide Pile, Memo from Dave Lang to Rick Leighton, September 10, 1986.
- Summary of Remedial Alternative Selection
- Responsiveness Summary

Description of Selected Remedy

Contaminated Soils and Sludges

The remedial action selected for the contaminated soils and sludges includes site grading, capping certain contaminated areas with a permeable soil cover and the implementation of institutional controls for all areas containing wastes to ensure the long term effectiveness of the remedial action. Operation and maintenance requirements will include water quality monitoring and post closure care consistent with relevant Resource Conservation and Recovery Act (RCRA) regulations. It is anticipated that water quality monitoring can be accomplished using existing monitoring wells.

Groundwater

The remedial action selected for the groundwater is an interim remedy of pumping and treating "hot spot" areas. This interim remedy will consist of several interceptor/recovery wells located to capture approximately eighty percent of the most contaminated portion of the plume. Recovered groundwater will be treated to control odors followed by air stripping to remove volatile organic compounds. The treated effluent will be discharged via a subsurface leaching pit to the upgradient portion of the aquifer. Concurrently with this action, a multiple source groundwater response plan will be developed and implemented to address the larger area groundwater problems. A final remedy for on-site groundwater problems will be developed and implemented consistent with the finding and conclusions of the multiple source groundwater response plan.

Operation and maintenance requirements will include operating and routine maintenance of the pumping system, periodic replacement of Hydrogen Peroxide and Ferric Chloride to keep the odor control system functional and routine inspection of the subsurface discharge system to ensure it is free from clogging. A monitoring program, consistent with RCRA requirements, capable of monitoring the effectiveness of contaminant removal from the aquifer and removal efficiency of the treatment system will be developed and implemented. The monitoring program will also monitor surface water quality to ensure compliance with water quality criteria and NPDES requirements.

Air

The remedial action selected for control of air emissions consists of stabilizing the side slopes of the East and West Hide Piles, installing a gas collection layer, capping with a synthetic membrane to establish impermeability and treating gaseous emissions with either activated carbon or thermal oxidation. The Agency has determined that either treatment system is equally protective of the public health, welfare and the environment. The final decision as to which treatment system will be selected will be made after the impermeable cover has been placed and the pile allowed to reach equilibrium. The final decision will be based primarily on the rate of gaseous discharge and other engineering criteria established during the Remedial Design process. The final treatment decision and the basis for it will be approved by the Regional Administrator in a subsequent document.

Operation and maintenance requirements involve the periodic and routine maintenance of the gas collection system and treatment system. Routine operations include replenishment of chemicals, regeneration of spent carbon as well as maintaining treatment efficiency. Implementation of an air quality monitoring program is also included as part of this task.

Declarations

Consistent with the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) and the National Contingency Plan (40 CFR Part 300), I have determined that the remedial actions selected for the site areas are cost-effective and provide adequate protection of the public health, welfare and the environment. The Commonwealth of Massachusetts has been consulted and concurs with the Agency's decision. In addition, the remedy will require certain operation and maintenance activities, as described above, to ensure its continued effectiveness. These operation and maintenance activities will be considered part of the approved action and are eligible for Trust Fund monies on a 90/10% cost share basis with the State for a period not to exceed one year. I have also determined that the action being taken is appropriate when balanced against the availability of Trust Fund monies at other sites.

9/30/82
Date

Michael R. Deland
Regional Administrator
EPA, Region I

SUMMARY OF REMEDIAL ALTERNATIVES SELECTION

INDUSTRI-PLEX SITE

Woburn, Massachusetts

September 1986

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Industri-plex Site
Woburn, Massachusetts

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SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

Industri-plex
Woburn, Massachusetts

I. SITE LOCATION AND DESCRIPTION

The Industri-plex site (the Site) is a 245 acre industrial park located in Woburn, Massachusetts (refer to Figure 1), an old industrial community located approximately ten miles northwest of Boston. Primarily known for its tannery industry at the turn of the century, Woburn is presently experiencing an economic revitalization with the infusion of a number of computer and service-related businesses. The intersection of two major highways, Route 128 traversing east to west and Route 93 oriented north and south, has turned the northeastern third of the city into a commercial/industrial area. Presently, the City has approximately 36,600 residents and is a mixture of light industrial, commercial, and residential properties.

Located in the industrially zoned northeast corner of Woburn, the Site is bounded by another industrial park and the community of Wilmington to the north, while Interstate Route 93 and the Town of Reading form the eastern border. A commuter rail line, oriented in a north-south direction, transects the western third of the Site. Commercial and light industrial/manufacturing companies are located to the north, west and south of the Site. The Site, then owned by a developer, Mark Phillip Trust, was undergoing commercial development when the presence of hazardous substances was detected in 1979. Presently, the majority of the Site is undeveloped; however, two portions contain some active businesses. To the west of the railroad tracks eleven buildings are built on areas containing some degree of contamination. Access to these buildings is via New Boston and Merrimac Streets. East of the tracks but west of Commerce Way are six buildings constructed on areas of suspected contamination. Access to these areas is by Commerce Way and Atlantic Avenue. No homes are located on or abut the Site. The nearest residences are located approximately three quarters of a mile to the north along Eames Street in the Town of Wilmington. To the south, another small residential neighborhood is located off Mishawum Road and Washington Street.

The hazardous substances problems at this site are primarily related to more than a century of manufacturing operations. Results from a privately funded Responsible Party remedial investigation indicate that the major environmental concerns at the Site involve soils and sludges contaminated with heavy metals, animal glue wastes emitting odors and two discrete groundwater plumes containing volatile organics. This investigation, conducted under an administrative Consent Order, was split into a two-phased study. Phase I focused on the entire Site, including an area to the north and east of Commerce Way subsquently found free of contamination. The Phase II study concentrated on providing a greater level of detail as to the extent of the problems on the contaminated portion of the property and developing feasible alternatives for remedying those problems. The Site boundaries for the Phase I study area are shown in Figure 2 and for the Phase II study area in Figure 3.

The Site is located in the Aberjona River Valley. Woburn is located on the Eastern Avelonian Platform of the Northern Appalachian Mountain System. The Site is located between the Northern Boundary and Blood Bluff fault zones which divide the greater Boston area into a series of northeast trending blocks. These blocks are in turn dissected by north/south trending faults, one of which has controlled the location of the Aberjona River Valley. The general area has a moderate relief with occasional bedrock outcrops scattered throughout. Vertical relief is approximately 40 feet above grade.

The bedrock at the Site is the Salem Gabbro-Diorite. At the northern portions of the site, bedrock is exposed as knobs and ridges throughout. Towards the south where the Aberjona River Valley is more pronounced, bedrock occurs as knobs rising rapidly from the valley to the east and west. See Figure 4 for well locations. Depth to bedrock ranges from zero (OW-2) to fifty feet below grade at OW-12 on the southern border of the site. South of the site a buried valley becomes increasingly narrower and deeper with depth to bedrock being 100 feet at OW-7. On the Site, the bedrock appears to be competent at topographic highs (OW-2) and fractured/jointed in lower areas (OW-9). Results of pumping and recovery tests indicate that the bedrock has relatively low permeabilities yielding less than 0.1 gpm to pumped wells OW-1, OW-2, OW-3. Well OW-9 yields 1 gpm, while OW-3 yields 2 gpm. Rock well OW-4 yields the highest values of 15 gpm; however, this yield was attributed to the well location abutting a rock quarrying operation with substantial blasting. Unconsolidated deposits immediately overlying the bedrock are low permeability glacial till, permeable outwash sands, peat and miscellaneous fill deposits.

The till mantles the irregular surface of the bedrock, being exposed where bedrock is near the surface and virtually non-existent at the center of the valley. The thickest deposit of till is located at the sides of the valley (OW-5 and OW-17) where maximum depths are 12 feet.

Glacio-fluvial outwash deposits overlay the till with a maximum thickness of 80 feet observed in the center of the valley near OW-20. The investigation indicated that these outwash deposits have a high degree of sorting and are uniform in size. Sand/gravel wells installed during the study indicate that this geologic unit has a high permeability and is capable of producing yields in excess of 500 gpm.

The buried valley begins at the southern end of the Site near OW-14 and OW-12. Two smaller valleys or troughs are present at the Site that merge with the buried valley. A smaller trough trends from the area of the Woburn City Dump (northwest of the site) through OW-11 to OW-14 to OW-12. South of OW-12 the center or deepest part of the buried valley extends through OW-18, OW-19 and OW-20. The valley is relatively narrow immediately below the Site but doubles in width in the area south of the Digital Equipment building (OW-19 and TB-6). The valley also becomes deeper to the south, away from the Site.

Since the buried valley deepens and the topography is gentle, the saturated thickness of the sand deposits becomes greater towards the south. At OW-12, 44 feet of sand above the bedrock are saturated with water as compared to 82 feet at OW-20.

Peat overlays the outwash deposits. This peat originally covered a substantial portion of the Site; however, the majority of it has been removed as part of the Site development. Peat was encountered in many borings and test pits, and the maximum thickness of 11.5 feet is south of Phillips Pond at OW-5.

Results of the groundwater monitoring program indicate that the area wide groundwater flows in a southerly direction into the buried valley. However, on-site hydrology is more complex. Groundwater on the western half of the Site as far east as the East Hide Pile flows into the buried valley near OW-17 while groundwater found just west of Commerce Way extension flows easterly, discharging into the marshes east of Commerce Way. Groundwater which does not intercept the marsh continues downgradient curving slowly to the southwest until it intercepts the buried valley down around OW-19 and 20.

Results of the groundwater mapping indicate that a groundwater mound exists near the center of the Site as a result of a sharp contrast in permeabilities between an elevated bedrock knob and the overlying waste materials. This mound serves to control groundwater flow locally and to keep the lower portions of the wastes saturated.

Groundwater flow rates have been estimated to range from 1 foot per year for bedrock to 5 feet per day for the most highly permeable outwash materials. Flow rates between 0.2 - 1 foot per day have been calculated for the buried valley south of the Site.

The groundwater in the immediate area of the Site is currently used solely for noncontact cooling water. The nearest municipal drinking water supply wells are approximately 1.25 miles downgradient. These wells, Wells G & H, have been out of service since June 1979 when they were found to contain elevated levels of volatile organics. The wells are currently listed as a separate site on the National Priorities List (NPL). Refer to Figure 1 for location of wells. The results of the Remedial Investigation/ Feasibility Study (RI/FS) and hydrogeological investigations of Wells G & H indicate that the two NPL sites are hydraulically connected. However, the same investigations also indicate that while contaminants in the groundwater from the Industri-plex have migrated off-site they have not impacted Wells G & H. The source of contamination in and around Wells G & H appears to originate from areas south of Route 128 and not from the Industri-plex area.

Within the Aberjona River Valley, surface water as well as groundwater generally tends to flow in a southerly direction toward Boston Harbor. The site is not located in a base (100 years) floodplain of the Aberjona River as defined by the HUD floodplain management maps. There are two significant streams and several small wetlands on the Site. The Aberjona River enters the Site from the northeast. The Aberjona crosses under Route 93 in two places; the more northerly segment enters the Site in the northeast corner, flowing in a southwesterly direction, meandering through a wetlands prior to discharging into an open swale that forms the centerline of Commerce Way. The southern branch of the Aberjona crosses under Route 93 and discharges into Phillip Pond, an artifically created pond to provide flood storage capacity for the proposed industrial park. The pond is located on the southeastern boundary of the Site and discharges through an open swale into the swale located along Commerce Way.

The other stream of concern is an unnamed brook that enters a flood storage pond, similar to Phillips Pond, created to assist in managing surface water run-off from a newly created industrial park abutting the Site along its northern border. The outlet of this pond flows over a dike and spillway onto the Site creating a shallow pond along the northern border. The pond and its associated wetlands, 4.1 acres in size, are located between the East and West Hide Piles, with an exposed arsenic and lead deposit forming the southern boundary of the pond. A review of historical aerial photographs indicates that these piles and deposits filled in a portion of the original pond and wetlands. The outlet of the pond forms a small brook that flows southeasterly intersecting the swale immediately upstream of the Aberjona River. Less significantly, streams found to the north and northwest of the Site are intercepted by a narrow drainage ditch abutting the westerly side of the railroad tracks on the western third of the Site. The railroad tracks serve as a surface water divide, forcing the water to flow in a southerly direction. Several small streams, including Hall's Brook, west of the Site, join this drainage ditch, ultimately passing under the railroad tracks and entering Hall's Brook Storage Area.

Hall's Brook Storage Area, located just south of the Site, was created by the developer to control stormwater runoff from the industrial park. The outlet of the storage area joins the Aberjona River just north of Mishawum Road. Refer to Figure 3 for location of wetlands and surface water flow patterns.

As noted previously, there are several wetlands found on or adjacent to the Site. These wetlands are found in the northeast and northwest portions of the Site. The wetland northeast of Commerce Way is approximately 11 acres in size, is uncontaminated and would not be impacted by remedial actions taken on other portions of the Site. The previously noted wetlands and pond situated between the East and West Hide Piles will need to be addressed as part of the remedial actions. The remaining wetland abuts the northwest corner of the Site, is upgradient of the Site and should not be affected by the remedial actions.

II. SITE HISTORY

Various manufacturing facilities operated on the Woburn Site from 1853 to 1968. Prior to 1853 the property was undeveloped land, covered forest along the northern, upland border and wetlands and marshy swampland over the southern two thirds of the Site.

SUMMARY OF SITE OWNERSHIP

Date	Ownership	Comments
Prior 1853	Unknown	natural undeveloped land
1853 to 1863	Robert B. Eaton	manufactured Hartshorn, Vitriol, Copperas, Glue, Gums, Nitrates
1863 to 1929	Merrimac Chemical Co. (New England Manufacturing Co. made munitions from 1915 to 1920)	manufactured many types of acids, Tin crystals, Oxy-Muriate of Antimony, Arsenical Pesticides. Waste products were arsenic, lead, zinc, copper and mercury
1929 1931	Monsanto Chemical Co.	Similar products to Merrimac Chemical Co.
1931 1934	F + L Land Salvage and Improvement Co.	Salvage existing plant equipment
1934	New England Chemical Industries, Inc.	manufacture of animal glues, "technical gelatin"
1936 1961	Consolidated Chemicals Industries	same products as previous owner
1961 1968	Stauffer Chemical Co.	same as previous owner
1968 present	Mark Phillip Trust	industrial developer

In February 1853, Robert Eaton purchased approximately 105 acres in North Woburn to establish the Woburn Chemical Works. Operations began in the summer of 1853 with the manufacture of chemicals for the local textile, leather and paper industries. In 1863 Robert Eaton joined three other individuals to form a company called Merrimac Chemical Company. This company continued to operate and expand the existing facilities.

During the period of 1858-1890, the main products of the Merrimac Chemical Company were sulfuric acid and related chemicals. At this time, sulfuric acid was the key to most chemical production, being the intermediate for many chemicals required by the previously mentioned industries.

In 1899, Merrimac purchased the William H. Swift Company (East Boston), a producer of arsenic insecticides, acetic acid and dry colors. Between 1899 and 1915, Merrimac became the leading U.S. producer of arsenic insecticides.

In 1915, Merrimac organized a separate company, located just east of the main plant, called the New England Manufacturing Company. The purpose of New England Manufacturing Company was to produce war materials, specifically munitions for World War I. Merrimac Chemical Company supplied New England Manufacturing Company with acid by a pipeline. New England Manufacturing produced organic chemicals, including phenol, benzene, picric acid and toluene and trinitrotoluene (TNT). During this period of time, Merrimac Chemical Company also acquired the entire plant, assets and goodwill of the Cochrane Chemical Company of Everett, Massachusetts.

In November, 1929, the Monsanto Chemical Works of St. Louis purchased and merged with the Merrimac Chemical Company. Merrimac was allowed to retain its identity as the Merrimac Division of Monsanto and continued to operate at the Site until 1931. By 1931 all Merrimac operations located in Woburn were consolidated to the Merrimac plant in Everett. From 1931 to 1934, no operations were conducted on the Site. Existing equipment was salvaged by F & L Land Salvage and, in 1934, the Site was sold to New England Chemical Industries.

From 1853 until 1929 the Site development was characterized by numerous small buildings scattered over 90 acres. Old maps of the Site show that these buildings were built or destroyed as quickly as there were changes in the demand for certain chemicals. It appears, based on a historical search and visual observations, that waste products were disposed of randomly over the years, usually wherever it was convenient, either to fill in a low spot or out behind a building.

New England Chemical began construction of an animal hide glue manufacturing plant on the site in 1934, and started up the plant in March, 1935. New England Chemical Company was purchased by Consolidated Chemical Company in 1936. Consolidated was purchased by Stauffer Chemical Company in the early 1960's. Stauffer continued plant operation until mid-1969, when it completed equipment removal and vacated the Site.

Glue was made by extracting a protein called collagen from animal tissue or bones with hot water. The raw materials included raw, salted or limed hides, hide fleshings, or chrome tanned leather scraps from cattle, hogs, sheep or other animals. Various steps were required to prepare these materials for cooking. Once prepared, the glue stock was cooked three times with the resulting cooking water (containing 3-5% glue) drawn off in order to be concentrated. The glue in the cooking water was concentrated using evaporators followed by a continuous belt dryer. Once dry, the glue was ground up and bagged for shipment. The material (called tankage) remaining in the bottom of the tank after cooking was disposed of on-site. The tankage consisted of wood shavings, raw products, and hide materials.

Disposal practices for the tankage and other byproducts of the glue operations were similar to those of Merrimac Chemical Company. On-site burial of the tankage, other solids and the sludge from the primary waste water settling lagoon occurred east of the plant. Frequently this entailed burying material directly on top of materials left behind from Merrimac's previous operations. The liquid effluent from the operation exited the plant from the southwest corner of the building into a grease and oil separator. The effluent then flowed into a primary settling basin, the effluent of which was discharged into the City of Woburn sewer line located next to the plant. Over the 35 years period of operations, the waste deposits accumulated to such an extent that large piles of hides and other wastes rising forty to fifty feet above grade covered a number of acres east of the plant.

In December, 1968, the Mark Phillip Trust purchased the property from Stauffer Chemical Company. Together with land he owned south and east of the Site, the Trust intended to develop the property as an industrial park to be called Industri-plex 128. The Trust began development in the early 1970's on the southern most section of the property, near Mishawum Road and Route 128. This involved filling and excavating portions of the property to facilitate sale of various parcels of property. Development continued northward in phases until the Trust reached the southern end of the Site in 1975. As site development began to encroach on the buried animal glue manufacturing wastes, a very strong and pervasive "rotten egg" odor was released into the surrounding areas. The odor, characteristic of hydrogen sulfide is caused by the anaerobic decomposition of the organic wastes. Because of the prevailing wind direction the odor routinely impacted the community of Reading to the east where it was known as "the Woburn Odor". Despite repeated complaints by local citizens and notices of violations issued by the Massachusetts Department of Environmental Quality Engineering (DEQE), the Trust continued its development, excavating the glue wastes and stockpiling them on the sides of a small pond on the northern border of the Site. These two stockpiles, or "hide piles" as they came to be known, filled a considerable portion of the pond and ultimately reached dimensions of up to 40 feet high, 250 feet long and 100 feet wide.

After repeated violations of its administrative orders, the DEQE and the Massachusetts Office of the Attorney General filed suit in Suffolk Superior Court. At approximately the same time, the Town of Reading filed a similar suit in Middlesex Superior Court. These two suits were merged, and in 1977 the Court issued an order prohibiting the Trust from disturbing two small parcels of land where the bulk of the remaining glue wastes were thought to be buried. The order was only partially successful in abating the odors since the stockpiles, especially the eastern one, continued to generate and release substantial amounts of hydrogen sulfide.

The State has a long history of enforcement actions against the Mark Phillip Trust's development of the property. These actions began in August of 1969 when the developer began work without the proper permits from the Massachusetts Department of Natural Resources (DNR). In December, 1970, The DNR issued a permit to the Trust; the permit acknowledged the existence of the former Stauffer wastewater treatment lagoon and disposal area and required that they be addressed in compliance with current state regulations.

Federal involvement began in June 1979 when the United States Attorney's office, on behalf of the U.S. Army Corps of Engineers (COE) and EPA, filed suit against the Trust alleging violations of §404 of the Federal Water Pollution Control Act which regulates the filling of wetlands. An injunction was issued and further development activity stopped. In support of this injunction EPA provided the results of its soil and water testing at the Site which showed that hazardous substances, primarily arsenic, chromium and lead sludges, had been released at the Site. Negotiations between the Trust and the state and federal regulatory agencies began and continued until May,1985, when separate state and federal Consent Decrees were approved by their respective courts. The decrees, similar in scope, required the Trust to undertake a series of steps, including investigations to determine the nature and extent of the hazardous waste problems, cleaning up the hazardous waste problems and resolving the wetland filling issues. In exchange, the Trust would be able to develop certain pieces of the property in order to generate enough revenue to continue with the remedial investigations and clean up. Citing the inability to generate sufficient capital, the Trust has never complied with the terms of the Consent Decrees.

Two response actions have been undertaken at the Site. The first, conducted by the DEQE in November 1980 involved a sprayed latex cover over a large exposed arsenic and lead deposit to minimize air entrainment of arsenic and lead dust. In the summer of 1981 the EPA undertook a removal action by installing a chainlink fence around the site to prevent unauthorized access to the Site. A subsequent removal action was undertaken in June 1986 to repair the existing fence.

In May, 1982, the Massachusetts Department of Environmental Quality Engineering (DEQE) and EPA entered into a Consent Order with Stauffer Chemical Company to undertake a Remedial Investigation/Feasibility Study (RI/FS) and subject to certain conditions to pay for its apportioned share of the remedial actions. Stauffer began implementing the Order in the summer of 1982 with Phase I of a remedial investigation and completed the RI/FS process in April 1985 with the submission of the Phase II RI/FS. These documents serve, in part, as the basis of this ROD.

As briefly noted previously, the waste products resulting from 115 years of industrial activities were randomly disposed of on-site. Prior to 1934 it appears that waste materials were disposed of over a wide area, encompassing all the property owned by Merrimac Chemical Company west of the current location of Commerce Way, including the property west of the railroad tracks. It appears that the wastes were used for two purposes; the first was to fill lowlands, wetlands and shallow ponds in order to provide more useable land on which to locate new processes. The second use was as a construction material used to build dikes and levees to contain liquid wastes in a particular area.

After 1934 and for the remainder of industrial operations, the disposal of waste products was more limited to areas east and southeast of the main plant. These wastes were deposited directly on top of the existing deposits and reached heights in excess of forty feet above natural grade. As the Trust began development on the Site it removed unsuitable material left behind by the previous operations, including waste deposits. This unsuitable material was either trucked off-site to a private landfill to be used as cover material, placed under the Boston Edison Right of Way (ROW) south of the Site or stockpiled on a second Boston Edison ROW on the northern border of the Site impinging on a shallow pond and wetland.

Presently the Site is a mixture of developed and undeveloped parcels of land containing the waste products of the former industrial operations. These deposits remain either as they were initially placed or as relocated to another location on the Site to facilitate site development. Site investigations indicate that under existing conditions the Site continues to release contaminants to the environment and poses a significant potential for the continued release. Sampling data indicate exposed arsenic, chromium and lead deposits are continuing to be transported to the area surface water and wetlands found on Site. While this finding does not appear to be presently impacting, to a significant degree, the water quality, these toxic metals will continue to accumulate in the bottom sediments and ultimately cause a long term environmental problem. The East and West Hide Piles because of slope stability problems continue to slough off substantial portions of the piles, releasing hydrogen sulfide gases to the atomsphere and toxic metals and soils into the pond and wetlands. Large areas of the contaminated soils are exposed at the surface thereby allowing individuals and animals to come in direct contact with arsenic, chromium and lead. Despite repeated attempts to exclude people from coming in contact with these metals, evidence suggests that individuals are routinely exposed to elevated levels of heavy metals resulting from their unauthorized presence on the Site.

III. CURRENT SITE STATUS

Pursuant to a Consent Order CERCLA § 106, Stauffer Chemical Company conducted a two phased RI and an FS for the Site, as shown on Figure 1.

A. Remedial Investigation

Results of the RI characterized current site conditions, defined the nature and extent of contamination, identified the pathways and receptors, and identified remedial alternatives for evaluation during the FS.

Phase I of the RI was designed to determine the types of contaminants present, their areal extent and the environmental media impacted. It entailed sampling the entire site and determined that the majority of the waste problems were contained on the western half of the Site. The area to the east of the proposed extension of Commerce Way contained none of the metals or hide deposits.

The Phase II investigation focused in greater detail on the area containing the wastes and documented the presence of approximately one million cubic yards of contaminated soils and sludges deposited over a hundred acre area. This material tends to be deposits containing arsenic, lead, zinc or copper derived from Merrimac Chemical's operations. The RI established that these materials reach a depth of eight feet below grade and that approximately fifteen percent of these materials were within the saturated zone. Materials generated during the glue manufacturing operations produced wastes containing elevated levels of chromium and organic material such as leather scraps, hair and fleshings. Originally, this material was deposited east of the Stauffer Chemical plant, directly upon the previous waste deposits. This material reached substantial heights above grade. However, as a result of recent Site development, much of this material was redistributed throughout the Site, as well as some of it being transported off-site. Currently the bulk of this material is contained in four discrete areas on-site, with heights exceeding thirty feet above grade. Results from the RI indicate that some of these sludge deposits containing toxic metals were in direct contact with groundwater and surface water. Sampling results of the surface water indicate that the present impact from these deposits are below applicable standards. Groundwater results indicate sporadic levels above drinking water standards; however, the impacts of the deposits on groundwater appear to be localized. During Phase II, however, two plumes of groundwater contaminated with benzene and toluene were discovered. The toluene plume originates just northeast of the intersection of Commerce Way and Atlantic Avenue. This plume is the only contaminant found east of Commerce Way. The benzene plume appears to originate on the southern side of Atlantic Avenue between 10 and 20 Atlantic Avenue.

As previously noted, the Site is located in a highly industrialized area of the City. Within the Industri-plex park itself, over sixty companies employ over 4,000 people. Within a half mile radius the numbers swell to over 200 businesses and 10,000 employees. The closest residential neighborhood is roughly three quarters of a mile to the northwest of the Site. The RI identified the potential pathways of contaminant migration as surface water, groundwater, air and direct contact with contaminated soils. The RI determined that soils presented two potential threats to receptors. The primary threat from soils was a direct contact threat to individuals traversing the Site. These individuals would either be from the industrial parks or more likely, persons who use the Site for recreational purposes, despite repeated attempts to restrict Site access. The second potential threat from soils, a less significant one, was the off-site migration of toxic metals via surface waters resulting from either direct contact of the deposits with the surface waters or run-off from a storm event. Surface waters flowing off-site pass Wells G and H and ultimately discharge into the Upper Mystic Lakes, a recreation area. Results from previous studies and the RI indicate that the prevailing wind direction is from the northwest, toward the east, southeast. Odors originating on-site tend to impact the east, southeastern portions of the industrial park and the western border of Reading, where approximately 5,000 people live. Residents of this neighborhood were the primary recipients of the odors during active Site development and as a result logged the most compliants with the DEQE.

Presently the groundwater leaving the Site is utilized solely for non-contact cooling water by several downgradient companies. It is not used for a potable water supply. Separate studies evaluating existing land-use patterns and aquifer characteristics indicate that the aquifer immediately downgradient of the Site would be unsuitable for use as a municipal water supply, given current regulations. Further downgradient, the aquifer was used as a potable water supply by the the City of Woburn. Woburn Wells G and H withdrew ground water from the aquifer underlying the Aberjona River. These wells were abandoned in May 1979 when they were found to be contaminated with volatile organic chemicals.

The RI/FS identified three areas requiring remedial actions:

- ° Soils: Approximately one hundred acres contained levels of arsenic, chromium, or lead above background values. These soils were determined to pose a direct contact threat.
- ° Air: Air emissions from the East Hide Pile contained hydrogen sulfide gas creating a substantial odor problem.
- ° Groundwater: Two groundwater plumes, one contaminated with benzene and the other with toluene, potentially impact the Wells G & H aquifer.

1. Soils

The RI verified that the majority of the hazardous wastes problems at the Site resulted from the presence of soils and sludges contaminated with toxic metals. The RI determined that these metals posed a direct contact threat to the public health and environment. While substantial quantities of zinc, copper and, to a lesser extent, mercury were detected, the primary metals of concern were arsenic, lead and chromium. In addition to the toxic metals, the organic materials such as hair, leather scraps and fleshings resulting from the glue manufacturing process are of concern. These organic material deposits release obnoxious odors when disturbed and the leachate discharges from the deposits adversely impact general water quality because these materials have a significant Biochemical Oxygen Demand (BOD).

Lead was the most prevalent contaminant of concern found on Site. Levels of lead ranged from background values (10 parts per million (ppm)) to a high of 54,400 ppm, the average value being 1,263 ppm. In most instances, where elevated levels of lead were detected arsenic levels were elevated also. This is the result of the manufacture of lead arsenate insecticide. Values for arsenic ranged from less than 10 ppm to 30,800 ppm, the average concentration being 288 ppm. Elevated levels of lead and arsenic were found on a total of approximately 57 acres. Approximately half the 57 acres contained values in excess of 1000 ppm. Figure 5 shows the approximate areal extent of the lead and arsenic contamination.

Both lead and arsenic have long been associated with significant long term health effects. The primary route of exposure to these metals at the Site is soil ingestion; however, skin contact and inhalation are also of concern. Lead poses a hazard to reproduction and exerts toxic effects on pregnancy and the fetus. Evidence suggests that lead has a toxic effect on the brain, central nervous system, the kidneys and hematopietic system. Chronic exposure by ingestion or inhalation can cause lead encephalopathy and in severe cases permanent brain damage. Lead has been particularily associated with detectable learning disabilities in children exposed to relatively low levels.

Arsenic is a human carcinogen causing skin tumors when it is ingested and lung tumors when inhaled. Arsenic has also been linked to chromosomal damage in humans as well as animals. An increased incidence of multiple malformations has been documented among children born to women occupationally exposed to arsenic.

Chromium in soils and hide deposits was the other major contaminant of concern. These wastes, associated with the disposal of glue manufacturing wastes, were detected above background levels on approximately thirty five acres. Chromium values ranged from background (less than 10 ppm) to a high of 80,600 ppm (average 718 ppm). Approximately half of the 35 acres of waste contained chromium values in excess of 1000 ppm. The RI indicates that elevated values of chromium are typically found in areas of hide deposit disposal or in the chrome lagoon area. Hide deposits, the source of the obnoxious odor, were confined to approximately 13 acres. Figure 6 depicts the hide deposit areas and the areal extent of wastes with elevated chromium values.

The health impacts of chromium are very dependent on its oxidation state. Hexavalent chromium has a greater adverse health impact than the trivalent form of chromium. Hexavalent chromium salts are found carcinogenic in laboratory animals and cause excess cases of lung cancer in workers occupationally exposed. Hexavalent chromium causes DNA and chromosomal damage in animals and humans. In addition, hexavalent chromium impacts the kidneys and to a lesser extent, the liver. Hexavalent chromium in the environment quickly reduces to the less toxic trivalent. The primary health effect associated with trivalent chromium is contact dermatitis in sensitive individuals. The RI/FS did not detect the presence of hexavalent chromium at the Site.

2. Air

The Site's impact on the surrounding air quality has historically been one of the major concerns associated with the Site. The odors emanating from the Site have been the source of much discussion and input from the surrounding community. Initially there was concern about the potential for particulates containing hazardous metals becoming entrained in the air of surrounding neighborhoods and fear of health hazards associated with the obnoxious odor resulting from the disturbance of hide waste deposits.

Prior to the RI, the Agency's Field Investigation Team (FIT) conducted an air emission survey for particulates containing metals. The survey concluded that the exposed metals deposits were not being entrained in the air and therefore were not producing an off-site impact. Additional air data collected as part of the RI health and safety plan also indicated that airborne particulates are not a problem.

The RI investigation of potential air impacts focused on locating and characterizing areas of potential air emissions, specifically odors. The Phase I investigation identified four areas containing buried glue manufacturing wastes that were actual or potential sources of odors. These are the East, West, East-Central and South Hide Piles. Phase II of the RI used several analytical techniques, as well as an odor evaluation panel to characterize the type and strength of the odors being emitted from each of the four waste areas.

The Phase II investigation used a field screening technique, called Bar hole sampling, to delineate potential sources of odors. Areas so identified were subjected to additional investigation. Air samples were collected by driving a steel bar two or three feet in the ground's surface to establish a temporary hole, inserting one end of a plastic sampling hose into the hole, and attaching the other end to a combustible gas meter and a hydrogen sulfide (H_2S) meter connected in series. Using a calibrated pump, a sample of air was withdrawn from the bar hole, passed through the meters and exhausted to the ambient air. Hydrogen Sulfide values were recorded in ppm and combustible gas as a percent of total gases measured for each hole.

Results of the Bar hole sampling indicate that each area identified as containing glue manufacturing wastes had detectable levels of combustible gas and H_2S, and therefore had the potential for emitting odors. The sampling identified the East Hide Pile as the area with the greatest potential for being a major odor source. All readings collected from the East Hide Pile had levels that exceeded the upper detection range of the instrumentation.

The majority of samples collected from the West Hide Pile were at the lower detection limit of the instruments; however, areas with elevated readings similar to those found in the East pile were found widely scattered throughout the pile. In these areas, values fluctuated wildly, with results ranging from not detectable to exceeding upper limits in bar holes less than three feet apart. These findings indicate that either the material deposited in the West Pile is different than that of the East Pile or that the physical composition of the pile controls and limits the potential odor emissions.

The results of the Bar hole analysis indicate that four discrete areas within the East Central Hide deposit have elevated levels of combustible gas and H_2S. These areas received additional investigation. The South Hide Pile, located east of the Chromium Lagoons produced only one small area with elevated levels. In addition to the four known hide deposit areas, the RI evaluated several other locations using the Bar hole technique.

Areas owned by Anthony S. Femmino, Mary E. Fitzgerald and John J. Mulhern/Michael A. Howland, Woodcraft Supplies and Boston Edison Electric Company Right of Way (ROW) number 9 all exhibited values in excess of 50 percent combustible gases and 250+ ppm of H_2S. Samples on the Mary E. Fitzgerald and John J. Mulhern/Michael A. Howland property and Anthony S. Femmino's property were severely limited due to asphalt pavement. Based on a knowledge of the site and results of the Bar Hole sampling, Stauffer installed seventeen four inch diameter boreholes to determine the quality and quantity of gases being emitted from the various deposits. Table 5 summarizes the generation rates of gases being emitted while Table 6 displays the chemical characteristics of the emissions. The conclusions reached by this program are:

- The East and West Hide Piles are the only locations actively releasing gases. Gas generation rates vary from borehole to borehole. The borings located within other areas did not exhibit gaseous release.

- Similarily, hydrogen sulfide readings vary considerably between boreholes. The methane gas tends to diffuse through the soil and decrease in concentration over distance, while the hydrogen sulfide appears to collect and stay within a narrowly defined area.

- While hydrogen sulfide and methane gases are the two primary constituents of concern, several other compounds were identified during the VOC analysis. These compounds are in substantially (order of magnitude) lower concentrations than the hydrogen sulfide.

- The gas release rates from the boreholes totalled 1.82 Standard Cubic Feet per Minute (SCFM) and 0.65 SCFM for the East and West Hide Pile, respectively.

The final phase of the air sampling involved characterizing the odors emanating from the Site. During active Site development, odors resulting from the disturbance of the animal glue manufacturing wastes pervaded the surrounding industrial parks and the neighorhood immediately east of Route 93. These odors adversely impacted the surrounding community and produced numerous complaints to the DEQE, as well as several lawsuits attempting to eliminate the odors by stopping development. Odors cause a special problem to regulatory agencies because the human nose can detect odors in the parts per trillion range while the most sensitive analytical instruments are only capable of detecting in the parts per billion range. As a result, the Arthur D. Little Company (ADL) odor evaluation team was retained to conduct an odor survey. Results of their findings are highlighted below and summarized on Table 7.

For each borehole the odor evaluation team determined the following; the number of dilutions necessary to reduce the odor to a threshold level where each member of the team was still able to barely detect the odor, the number of dilutions required to reduce the odor to varying qualitative judgments as to its intensity, termed total intensity of aroma (TIA), and the primary characteristics of the odor. The odor team suggested that the dilution TIA is an indicator of complaint/intensity of odor. Using information gathered during this effort the odor team concluded:

- Hydrogen sulfide was the characteristic odor of concern.
- The East Hide Pile was the primary source of odors, with seven of the fifteen boreholes producing odors in sufficient quantity to require up to a million dilutions to reduce the odors to the detection level.
- The remaining piles, West, East-Central and South, were not significant contributors to the odors detected on-site.

The EA evaluated the acute and chronic risks associated with volatiles potentially being emitted from the animal glue manufacturing waste deposits. Hydrogen Sulfide, Mercaptans, Benzene and Toluene were the compounds of interest. Of these compounds, H_2S was determined to be the indicator compound. H_2S is primarily a respiratory irritant. In high concentrations (500-1000 ppm) H_2S acts primarily as a systemic poison, causing unconsciousness and death through respiratory paralysis. In lower concentrations (50-100 ppm) H_2S acts primarily as a respiratory irritant. A literature review indicates that pulmonary edema and bronchial pneumonia may follow prolonged exposure at concentrations of the order of 250-600 ppm. At low concentrations (5-100 ppm) H_2S effects the eyes, with conjunctivitis being the most common effect.

The RI found that in the breathing zone vicinity of the waste piles, H_2S was at nondetectable levels (less than 0.5 ppm). However, for the purposes of calculating a potential exposure to hide pile emissions a value of 0.5 ppm H_2S was assumed. Based on the relative concentration ratios derived from borehole air measurements, the ambient air directly around the waste piles should contain no more than an average of 5 ppb of total mercaptans and 5 ppb of total aromatic compounds (benzene, toluene). Based on these assumptions, the EA determined that air emissions from the hide deposits would not adversely impact the public health if the no action alternative was selected.

3. Groundwater

The RI investigated the potential for on-site materials to adversely impact the local and regional groundwater. Initially, fifteen monitoring were installed and sampled during Phase I of the RI. An additional nine wells were installed and sampled under the second phase. Locations of these wells can be found on Figure 4.

The aquifer underlying the Site is currently not used as a potable water supply; however, several nearby companies do extract groundwater for non-contact cooling water purposes. The closest potable water supply was Wells G & H approximately one and a half miles downgradient. These Wells have been unused since 1979 as a result of contamination from chlorinated volatile organics. The Wells are currently listed on the NPL as a separate site.

The RI determined that the Site is located over the upgradient portions of the Aberjona River aquifer. This determination was based on data collected as part of the Site groundwater monitoring plan as well as a review of the regional geology and groundwater characteristics. Groundwater flow northeast and upgradient of the pond located between the East and West Hide Piles tends to discharge into the pond, while groundwater to the north, northwest of this pond flows in a southeasterly direction until it intercepts the buried valley that lies just east of and parallel to the railroad tracks. Groundwater directly south of the pond discharges directly into the previously noted buried valley. Groundwater located to the east and southeast of the pond, because of a bedrock high, tends to flow to the southeast prior to arcing in a southwesterly direction, joining the buried valley south of the Site. The groundwater leaving the Site continues to flow in a southerly direction, ultimately moving into the aquifer underlying Wells G and H. It appears, based on limited data, that some portion of the groundwater discharges to the surface water at Hall's Brook Storage Area.

Groundwater samples collected during Phase I and Phase II RI were analyzed for metals and priority pollutants. Results from the RI are briefly summarized in the following paragraphs. During the Phase I sampling, wells OW-5, OW-7, OW-9, OW-12, and OW-14 produced results above the drinking water standards for metals. With the exception of OW-12 where 54 ppb and 120 ppb of chromium was detected in Phase I and II respectively, the elevated levels in these wells were not replicated in Phase II. Analysis of groundwater for metals in Phase II indicated that wells OW-12, OW-13, OW-16, OW-17 and OW-20A each contained one metal above drinking water standards.

Wells with Metals exceeding Drinking Water Standards
for Phase I and Phase II sampling rounds (ppb)

	Arsenic		Lead		Chromium		Cadmium	
Well	I	II	I	II	I	II	I	II
OW-5	200	ND						
OW-7			120	ND				
OW-9	420	ND						

Wells with Metals exceeding Drinking Water Standards for Phase I and Phase II sampling rounds (ppb) cont'd

	Arsenic		Lead		Chromium		Cadmium	
Well	I	II	I	II	I	II	I	II
OW-12					54	120	11	ND
OW-13			ND	120				
OW-14			74	ND				
OW-16						100		
OW-17				70				
OW-20A		106						

As evidenced by the table above, metals in ground water were found sporadically in the monitoring wells. Despite these sporadic positive results, the RI concluded that the metal deposits found on-site posed only a localized impact and that the general off-site groundwater quality was not impacted sufficiently to warrant remedial action. This conclusion was based on several observations. First, the majority of the wells with elevated levels were wells either drilled through known waste deposits or located immediately downgradient of a deposit. Secondly, the metals of concern are relatively insoluble in groundwater at the pHs found at the Site, therefore they tend not to leach. This fact is verified by the results of the EP Toxicity testing performed on a number of samples. Sample results indicate that all values were below the accepted level of fifty times the drinking water standards. For those limited amounts of metals which do leach out, they quickly precipitate, attenuating on the soil matrices, thereby producing a localized condition. As a result, the RI concluded that actions taken to remediate groundwater contaminated with toxic metals was unnecessary. With respect to groundwater contamination not associated with metals, Phase I sampling indicated that virtually every monitoring well including those upgradient or laterally to the site contained trace levels of organic compounds. In addition, Phase II sampling during the RI did discover two discrete plumes containing volatile organics (benzene and toluene) emanating from the Site as well as low levels of volatile organics, different than those found on-site, entering the Site from sources upgradient.

In the Phase II (1983) monitoring program, significant concentrations of benzene, toluene and several other priority pollutants, not previously detected in Phase I, were discovered in four wells, OW-12, OW-14, OW-16 and OW-17. As a result, four additional permanent wells, OW-19, OW-19A, OW-20 and OW-20A, were installed downgradient of OW-17 to detect the extent of downgradient migration. In addition to the four permanent wells, sixty-one temporary monitoring wells were installed upgradient and downgradient of OW-16 and OW-12 to characterize the areal and vertical extent of contamination. A review of historical information and a search of City records for possible underground storage tanks was also conducted as part of the RI. The RI failed to produce any information as to the probable origin of the contamination; however, it concluded that the plumes are limited in extent and there were three possible source areas for the toluene: 1) upgradient of SD-4 on the east flank of the hide burial ground; 2) upgradient of OW-16, just north of the intersection of Commerce Way and Atlantic Ave.; and 3) on the southwest flank of the hide burial ground near SD-46. The source of the benzene is in the developed area just south of Atlantic Ave. Results of these additional investigations are shown in Figures 7, 8 and 9.

The RI focused on the Site specific groundwater problems and did not attempt to identify the other possible sources of either the upgradient or adjacent groundwater contamination; however, preliminary investigations in the general area of the Site prior to the start of the RI indicate that a number of potential problems exist. Results of these surveys indicate the following:

- As a result of a long history of industrial development in the general area, there are numerous potential contaminant sources impacting the groundwater.

- The City of Woburn landfill, located adjacent to the northwest corner of the Site, is hydrologically upgradient of the Site. Several groundwater investigations have been conducted in relation to the landfill, indicating a leaching problem. Because the landfill is regulated under the state's solid waste regulations, the DEQE has primary responsibility to resolve problems associated with the landfill. The City is currently attempting to comply with all the DEQE's requirements.

- To the north of the Site, bordering either side of the railroad tracks, are several active industries currently under state orders for remediating groundwater problems caused by their operations.

- Other potential groundwater impacts include two active barrel reclamation operations and two major trunk sewer lines paralleling the railroad tracks. These sewers receive industrial wastes and are known to have exfiltration problems.

- In addition to the above noted problems, the general area experiences an unusually high traffic load as a result of the numerous small companies located throughout the industrial parks. The increased traffic patterns

> increase the potential for an accidental spill. In areas presently undeveloped, evidence of unregulated disposal exists, such as cans, boxes, household trash and used motor oil.

The RI evaluated, as part of the EA, the potential impacts to the public health and environment from groundwater containing benzene, toluene, arsenic, lead, cyanide, zinc, di(ethylhexyl) phthalate (DEHP) or total phenols. The calculations found in the EA are based on the impacts to Wells G and H, an actual receptor point, though not one currently in use. Current agency guidance requires the EA to evaluate potential impacts on the nearest receptors, (i.e., groundwater immediately off-site). For the purposes of identifying the compounds of concern, the assessment as outlined in the EA will be sufficient. From the EA conclusion that impacts at Wells G and H are unacceptable one can conclude that impacts immediately off-site will also be unacceptable.

The RI used a two dimensional groundwater flow model to calculate concentrations of contaminants that would reach Wells G and H. The RI used the maximum concentration found for each contaminant as input into the dispersion formula calculations. The calculation assumed that dispersion was the only factor that would limit the concentrations from ultimately reaching Wells G & H. The precise risks created by off-site groundwater contamination are discussed in the EA and include carcinogenic and non-carcinogenic effects.

The EA assumed that no attenuation of the contaminants would take place. Results from the model are noted below:

Concentrations of Contaminants reaching Wells G & H
(ppb)

Compound	Conc. @ Wells	Applicable Standard	
Arsenic	7-13	50	(1)
Lead	2.5	50	(1)
Zinc	1800	5,000	(1)
Cyanide	0.3	----	
Benzene	5-10	6.7	(2)
Toluene	35	14,300	(3)
DEHP	0.1	----	
Phenols	140	3,500	(3)

(1) Drinking Water Standards
(2) SNARLS level
(3) Human Health Protection Criteria

As result of the EA, the RI determined that benzene was the contaminant of concern, and would require remedial action to be protective of the public health. The potential health effects of the chemicals of concern are briefly discussed in earlier portions of this section.

IV. ALTERNATIVES EVALUATION

The overall objective of the remedial actions at the Site is to effectively mitigate and minimize threats to and provide adequate protection of public health, welfare and the environment. Specifically, the FS evaluated alternatives which addressed the following three remedial objectives:

1. Protection of the public health and surface waters from direct contact exposure to soils/sludges contaminated with elevated levels of arsenic, lead and chromium.

2. Protection of the public health, welfare and environment from the contaminated soils, odors and leachate in or emanating from the East Hide Pile.

3. Protection of the public health and environment from groundwater contaminated with benzene and toluene.

A. Alternatives Development, Screening and Analysis

Pursuant to § 300.68 (f) 74 alternatives were developed for possible application at this Site. Each alternative was screened with the criteria set forth in § 300.68 (g). Waste characteristics and general Site conditions permit the application of discrete remedial alternatives to each environmental problem, much like a series of operable units. For example, a discrete set of remedial alternatives to address the direct contact problems associated with the contaminated soils was developed and screened. Similarily, sets for air and groundwater actions were also developed. Remedial alternatives to abate any potential impacts to surface waters were incorporated as part of other media's actions. With the exception of the pond and wetlands between the East and West Hide Piles, surface water actions were addressed as part of the soils evaluation. For the pond, its remedial action was incorporated into the evaluation of the East Hide Pile alternatives, referred to as the air alternatives. As a result, the development of alternatives and initial screening are listed by type of media being addressed.

The FS developed and screened a number of classes of alternatives that are based on similar technologies. Because of these similarities, these technologies provide the same relative benefits and problems, and therefore the FS screened these alternatives as classes instead of discrete alternatives. For example, all stabilization/solidification technologies were screened as a group.

Section 300.68 (g) specifies three broad criteria, cost, acceptable engineering practices and effectiveness, to be applied to the list of alternatives. In applying the cost criteria, the RI evaluated the present worth cost of each alternative. In the majority of cases, differences in costs were not the reason for rejection of an alternative.

The remaining two criteria, acceptable engineering practices and effectiveness are less quantifiable and more dependent on experience and judgment. The nature of the hazardous waste problems and general site conditions permit a wide range of potential alternatives to be considered. When viewed in light of the remedial objectives, however, a number of these alternatives were excluded during the initial screening.

The remedial alternatives not eliminated during the intial screening were retained for a detailed evaluation consistent with 40 CFR Part 300.68(h) which requires that the following factors, as appropriate, be considered:

(i) Refinement and specification of alternatives in detail, with emphasis on use of established technology.

Innovative or advanced technology shall, as appropriate, be evaluated as an alternative to conventional technology.

(ii) Detailed cost estimation, including operation and maintenance costs, and distribution of costs over time;

(iii) Evaluation in terms of engineering implementaiton, reliability, and constructability;

(iv) An assessment of the extent to which the alternative is expected to effectively prevent, mitigate, or minimize threats to, and provide adequate protection of public health and welfare and the environment. This shall include an evaluation of the extent to which the alternative attains or exceeds applicable or relevant and appropriate Federal public health and environmental requirements. [Where the analysis determines that Federal public health and environmental requirements are not applicable or relevant and appropriate, the analysis shall, as appropriate, evaluate the risks of the various exposure levels projected or remaining after implementation of the alternative under consideration];

(v) An analysis of whether recycle/reuse, waste minimization, waste biodegradation, or destruction or other advanced, innovative, or alternative technologies is appropriate to reliably minimize present or future threats to public health or welfare or the environment;

(vi) An analysis of any adverse environmental impacts, methods for mitigating these impacts, and costs of mitigation.

For ease of reading, each environmental problem identified in the FS will be discussed separately. Beginning with soils, discussion of initial screening of alternatives will be followed by the detailed analysis for that particular problem.

For each alternative evaluated under this section a brief summary of whether the alternative meets or exceeds applicable or relevant and appropriate Federal public health and environmental requirements will be included in the narrative. For a more detailed analysis of the applicable or relevant and appropriate requirements the reader is referred to the section labeled Consistency with Other Environmental Requirements.

B. Development and Screening of Soils Alternatives

The RI determined that there exists a potential for the public to come in direct contact with soils contaminated with arsenic, lead or chromium. The RI also identified areas where these soils were in contact with surface water or wetlands. Under adverse conditions, these deposits could impact the environment. The FS evaluated a number of alternatives to abate the direct contact problems associated with the metal deposits. Listed below are the remedial alternatives developed for the initial screening for the soils problem.

SOILS ALTERNATIVES

- No Action

Infiltration Control

- Regrade and revegetate contaminated areas to promote site drainage.
- Regrade and cap contaminated areas with clay material.
- Regrade and cap contaminated areas with a synthetic liner.
- Regrade and cap contaminated areas with an asphalt cover.

Removal/Consolidation

- Excavate contaminated areas to depth of water table with off-site disposal.
- Excavate contaminated areas to depth 6 inches below visual detection, with off-site disposal.
- Excavate contaminated areas to depth 6 inches below visual detection, consolidate between East and East Central Hide Piles, and cap.
- Excavate contaminated areas to depth 6 inches below visual detection, consolidate around East-Central Hide Pile, and cap.

- Excavate contaminated areas to depth 6 inches below visual detection, consolidate between East and East-Central Hide Piles, and cap.

- Excavate contaminated areas, construct RCRA-permitted hazardous waste facility, consolidate waste, cap according to RCRA regulation.

- Excavate and land farm contaminated areas.

- Excavate contaminated areas, encapsulate, and rebury on-site.

Soil/Sediment Treatment

- Incinerate excavated contaminated areas and dispose residue on or off-site.

- Wet air oxidation of excavated contaminated areas and dispose residue on or off-site.

- Cement-based solidification of contaminated areas.

- Lime-based solidification of contaminated areas.

- Thermoplastic-based solidification of contaminated areas.

- Organic polymer-based solidification of contaminated areas.

- Classification-based solidification of contaminated areas.

- Apply solution mining technology to contaminated areas.

- Apply neutralization/detoxification technology to contaminated areas.

- Seed contaminated areas with micro-organisms to achieve degradation and stabilization.

Access/Development Limitation

- Surround site with chain link/barbed wire fence.

- Surround contaminated areas with chain link/barbed wire fence.

- Establish deed restrictions for contaminated area.

- Provide 6 inches of topsoil where necessary and vegetate.

Each alternative was screened to determine its effectiveness in eliminating the potential for direct contact. Additional measures of effectiveness included rendering the wastes inert and minimizing their potential for leaching contaminants into the environment.

A number of remedial alternatives involving various stabilization/solidification techniques were subject to the initial screening. These techniques involve the mixing of a solidifying agent with the waste material to either physically surround or chemically fix the waste into a hard stable mass.

The stabilization/solidification techniques evolved from the Department of Transportation's regulation of the transportation of radioactive waste. As such, many of the techniques used were designed for temporary stabilization of waste and not necessarily long term stability. In addition, these techniques are very waste-specific and require a substantial amount of analytical investigation to determine their effectiveness and compatibility with the waste. Costs associated with these techniques are presently quite high and as a result, it was estimated that implementation of this technique would cost approximately an order of magnitude greater than other techniques capable of obtaining the stated objectives. These remedial alternatives were therefore eliminated from futher evaluation based on cost, acceptable engineering practices and effectiveness.

Encapsulation/Reburial of the contaminated soils was evaluated as a technique which might provide a long term solution for the Site. Encapsulation involves the use of a synthetic compound to physically enclose the waste. At some sites this method has been found to be protective of the public health and environment. It has effectively eliminated the potential for direct contact, reduced infiltration and minimized the potential for leaching. Presently however, this technique has just emerged from bench-scale testing, and no commercially sized unit has been built. Therefore, there is no data to support its long term reliability or engineering feasibility as a remedial alternative. The costs associated with this method are also very high. This technique was eliminated from further analysis.

High temperature incineration with on-site ash disposal was screened. While it is an attractive alternative because it permanently destroys the hazardous waste with no hazardous byproducts, it is not applicable to heavy metals because they cannot be destroyed by oxidation. Thus it was excluded from further consideration.

The use of wet air oxidation/residue reburial was also excluded for reason noted above with respect to high temperature incineration.

Landfarming and in-situ microbial degradation are techniques that use the assimilative capacity of plants or microbes to break down the waste. Under certain conditions these techniques are capable of being effective for a wide range of organic compounds. Metals cannot be broken down however, and as a result this technique was discarded from further consideration.

In-situ solution mining was evaluated as an alternative for metals removal. The technique involves injecting a solvent, usually water or some other aqueous solution, into the area of contamination. The contaminant is stripped from the soils and the contaminated elutriate is recovered, and pumped to the surface for treatment or disposal. This technique is most effective when the contaminated area is relatively homogenous and the contaminant is relatively mobile in the soil. Neither case exists at the Site. In addition, the technique has only seen limited application, usually to areas where a spill has occurred. The size of contaminated area at this Site coupled with the associated problems of collection and disposal make this alternative infeasible for use at the Site. Therefore, this alternative was rejected on the basis of acceptable engineering practices.

The remaining class of techniques considered and rejected was in-situ neutralization/detoxification. Presently this technique is limited to specific chemical contaminants. Given the heterogeneous nature and size of the Site, this alternative is impractical. It was eliminated from further consideration.

C. Detailed Analysis of Soils Alternatives

The retained alternatives were analyzed in greater detail pursuant to 40 C.F.R. Part 300.68 (h). Each alternative was evaluated using the six criteria previously noted.

The FS evaluated thirteen alternatives for the control of the direct contact threat posed by the arsenic, chrome and lead, soils and sludges. These alternatives ranged from the no action alternative to complete off-site removal and disposal.

For ease of reading, the alternatives as discussed in this document will be renumbered from those found in the RI/FS. The changes are summarized below:

New Number	Old number found in RI/FS
S-1 Shall be considered the No Action Alternative	Not specifically addressed in FS as a discrete remedial alternative
S-2	Alternative I page 64
S-3	Alternative II page 65
S-4	Alternative III page 66
S-5	Alternative IV page 67
S-6	Alternative V page 68

S-7	Alternative VI page 69
S-8	Alternative VII page 70
S-9	Alternative VIII page 71
S-10	Alternative IX page 72
S-11	Alternative X page 72
S-12	Alternative XI page 73
S-13	Option II listed in Appendix I. It is the complete off-site disposal option

Based on the EA, the objective of the remedial alternatives addressing contaminated soils and sludges is to prevent the public from coming into direct contact with these materials. The FS analyzed various combinations of caps, both permeable and impermeable, methods of waste removal and consolidation. The FS, completed prior to the current NCP, made several assumptions to form the basis for its evaluation of alternatives. First, the FS assumed that physical barriers between the wastes and the public would meet the remedial objectives for the Site. Second, once the remedial action was implemented, the primary concern would be ensuring that the wastes would not become exposed again. In this regard, the effects of the freeze-thaw cycle and of erosion are the two primary factors most likely to impact the long term effectiveness of the remedial action. Based on these assumptions, the FS further assumes that buildings, lawns and parking lots covering contaminated land would be at least as effective as barriers specifically designed to eliminate the potential for direct contact and would resist the effects of erosion and the freeze-thaw cycle.

Based on these reasonable assumptions the evaluation of the alternatives within the FS does not specifically address developed properties. The FS assumed that developed properties would not require remedial actions. If, however, excavation or removal alternatives were selected, the volume and costs for excavating in developed areas would be significant. For the in-site capping alternatives, institutional controls and existing structures would act as effective barriers to eliminate the potential for direct contact. The cost of additional fill required to cover grassed areas within the developed portion of the Site would need to be developed and added to the total remedial action costs.

S-1 No Action

The no action alternative for contaminated soils was not specifically delineated in the FS as a discrete alternative. Site conditions and RI sampling results indicated that exposed deposits containing high levels of metals pose a direct contact threat. As a result it was assumed that a no action alternative was not a feasible option. For the purpose of this document the no action alternative will be discussed.

A no action alternative assumes that no remedial actions are taken to abate or address problems at the Site, with the exception of quarterly sampling of ground and surface waters and air quality to monitor Site conditions for evidence of a substantial change. Since institutional controls restricting disturbance of the Site are considered a form of remedial action, the no action alternative would permit unrestricted development of the Site. Not only would the hide piles and metals deposits remain exposed at the surface and in contact with Site surface waters, but also during site development these materials would be moved, thereby creating new releases impacting the public health, welfare and environment.

Costs associated with this alternative only involve monitoring costs at $90,000 per year or a present work cost of $850,000 for thirty years.

The implementation of S-1 requires no special engineering techniques as it only requires periodic monitoring. The only permanent structures would be the groundwater monitoring wells, which are reliable and easily constructed. Due to their nature and characteristics the wastes if left undisturbed, will remain relatively stable. If however, Site development is permitted to resume, the reliability of this alternative changes dramatically, releasing odors and toxic dusts to the surrounding community, increasing the direct contact potential and discharging contaminants into the Site surface waters.

The no action alternative does not prevent or abate the threats to or provide adequate protection of public health and welfare and the environment. Under this alternative exposed deposits permit direct contact. They are also toxic to vegetation and will thus remain subject to erosion by surface water run-off. The northern half of the Site is presently undeveloped thereby providing a prime area for easy access. In addition the Site tends to be a local meeting and socializing spot for the area's teenage population. These unauthorized Site activities continue despite repeated attempts at maintaining a chain link fence and posting the Site with warning signs.

As a result, this alternative was found not to be protective of the public health, welfare or environment. In addition, this alternative does not meet or exceed applicable or relevant and appropriate Federal requirements as it would permit the continued release of toxic metal contaminants to impact surface water in violation of Water Quality Criteria. The applicability, relevance and appropriateness of these regulations will be discussed in a subsequent section of this document.
The alternative does not address any form of waste minimization, reuse or containment of the waste.

S-2 Cover contaminated soil deposits having greater than 100ppm of any toxic metal with a 24 inch clay barrier, followed by 6 inches of top soil and establish a vegetative cover.

Alternative S-2 is a source control remedial action that involves leaving the waste deposits in their current location and eliminates any potential for direct contact with the wastes through the use of containment techniques. This alternative involves modifying the Site's contours to establish uniform slopes and covering any contaminated deposits containing above 100 ppm of arsenic, chromium or lead with 24 inch of impermeable material (bentonite/soil mixture with 10^{-7} cm/sec permeability) followed by a 6 inch top soil cover with vegetation. As part of this alternative, the shallow pond located between the East and West Hide Piles would be drained and filled. The use of institutional controls to ensure the effectiveness of the remedial action is included as part of the alternative.

The cover proposed in this alternative would eliminate the direct contact threat by placing the metals deposits below the zone where the freeze-thaw cycle force them back to the surface. Weather conditions in New England produce an action called the freeze-thaw cycle. This cycle produces an effect that tends to force objects and materials found within the frost zone to the surface. An example of this phenomenon is found every spring when farmers "harvest" another crop of rocks that have been pushed to the surface as a result of the previous winter's frosts. Results of field experiences gained in the region indicate that covering with approximately thirty inches of cover material is effective in minimizing the effects of the freeze-thaw cycle. This alternative has the added benefit of providing a level of impermeability which would effectively exclude infiltration from migrating through the wastes. As noted in the previous section, the RI results indicate that while a portion of the metals deposits are in direct contact with groundwater, remedial action relative to leaching of toxic metals was not necessary. Therefore the use of an impermeable cover is unnecessary for preventing continued leaching of wastes to the groundwater, however it is effective in eliminating the potential for direct contact.

As noted above, part of the S-2 proposal is to drain and fill a shallow pond along the northern border of the Site. This action would eliminate approximately 4.1 acres of pond and associated wetlands. The elimination of the pond would serve two purposes. First, the RI determined that several waste deposits including portions of the East and West Hide Piles were in direct contact with the pond. Draining and filling the pond would effectively eliminate the potential for direct contact and future surface water quality impacts. The second reason is that the FS concluded that it was the most effective method for addressing and resolving the air pollution problems resulting from the East Hide Pile. The relationship between draining the wetland and the hide piles will be discussed in detail in the air pollution section of this document. For the purposes of evaluating this proposed remedial action it should be noted that limited water quality analysis conducted prior to and during the RI did not detect any significant present impact of the metal sludges on the surface water quality.

Because the draining and filling of the pond and its associated wetlands is included in every soils alternative except the no action alternative, S-1, it is important to address the applicable or relevant and appropriate Federal public health and environmental requirements in more detail now.

The presence of a wetlands is one of the most important environmental media requiring protection. A wetland serves many functions such as a habitat for water fowl, animals, plants and numerous species of aquatic life. In addition to serving as a habitat, wetlands act as nature's treatment system filtering out and trapping pollutants. While hardy in many respects, the continued good health of a wetland requires a fragile ecological balance. As a result, the Agency is committed to retaining, in their natural state, as many wetlands as possible. Section 404(b) of the Clean Water Act (CWA) is the statute governing the discharge of dredge and fill material into a wetlands. Primary authority for administering § 404(b) of the CWA rests with the Army Corps of Engineers (ACE). Section 404(b) addresses the discharge of dredge or fill into a wetlands; if fill is removed or dredged from the wetlands § 404(b) technically does not apply. Federal actions conducted in a wetlands which could potentially impact the wetlands is controlled under Executive Order 11990. Executive Order 11990 is much broader in scope than § 404(b) of the CWA. The executive order effectively prohibits any action from impacting a wetlands unless it can be demonstrated that no practical alternative exists to completing the required action. Any action ultimately undertaken involving wetlands must minimize to the extent practicable any adverse impacts to the wetlands. The criteria and requirements of § 404(b) are used during the implementation of the executive order. As noted above, several toxic metals deposits were in contact with the wetlands as well as portions of the East and West Hide Piles. Because of proximity of the wastes with the wetlands there exists no alternative which does not impact the wetlands. As stated earlier, the action of taking no action allows the continued release or threat of release of contaminants into the environment. All other alternatives would also impact the wetlands to some degree. If only the toxic metal deposits and not the hide piles were needed to be removed, then a practicable alternative would be the excavation of these materials from the wetlands thereby increasing the flood storage capacity of the wetlands - a positive impact. This action would comply with § 404(b) as it does not discharge dredge or fill material into a wetland and minimizes to the extent practicable the impacts to the wetlands, as required by the Executive Order

#11990. However, the disturbance or removal of the hide deposits would create the release of an obnoxious odor adversely impacting the surrounding community's welfare. Because the release or threat of release of this odor has created much concern within the community and nearby workers within the industrial parks the FS instead recommended the draining and filling of the wetlands. This alternative eliminated the need to disturb the hide piles, eliminated the potential for direct contact and assisted in the effective implementation of remedial actions required for the air alternatives (specifically addressed in detail in the air section).

This alternative was found to be protective of the public health by eliminating the potential for direct contact. In addition, the alternative would meet Water Quality Criteria by eliminating any future impacts to the surface water. However, as noted above, the alternative does not meet or exceed applicable or relevant and appropriate Federal public health and environmental requirements. Clearly, the elimination of the pond and wetlands is in direct conflict with Executive Order #11990.

Post closure monitoring and maintenance would be consistent with RCRA regulations § 264.310, and §264 Subpart G concerning landfill closure and post closure and groundwater monitoring.

The implementation of this alternative uses sound and well tested construction techniques. However the availability of a suitable clay source in sufficient quantity and the installation of the cap around existing structures while maintaining an effective impermeable layer are two major concerns. The time required to implement this remedial action and the ability to bring sufficient quantity of material to the Site without a substantial disruption of local traffic are additional concerns. Proper maintenance and monitoring would ensure the effectiveness and reliability of the remedial action. The alternative does not make use of any techniques to reuse, minimize or destroy the waste material. Therefore, the cap system must be maintained and monitored indefinitely since in-situ physical, chemical, or biodegradation mechanisms are not expected to ever reduce the material to a non-hazardous classification. Finally, institutional controls would be imperative to ensure that future land uses did not disrupt the cover.
The useful life of a properly maintained clay cap is estimated to be greater than 50 years, at which time replacement may be required. The surface cap system is a reliable and well-demonstrated technology which prevents surface water infiltration through the buried waste material. Operation and maintenance requirements are not complex. They include long term groundwater monitoring, cap maintenance and mowing to maintain grass cover and prevent tree growth. The facility would have to be maintained indefinitely. The area of the site cap would not be available for future development. Deed restrictions would be required to enforce this provision.

The capital, operation and maintenance, and present worth costs of this alternative are summarized in Table 30. There are no identified site conditions or waste characteristics that would adversely impact the implementation or construction of this alternative at the site. However, there are several concerns which require resolution prior to implementation of the remedial action. The major adverse environmental impact under this alternative is the elimination of a wetlands. As discussed earlier in this alternative, the elimination of the pond and wetlands would not be required to meet the established objectives for the Site if it were not for the need to drain and fill the wetlands to control the problems associated with the East Hide Pile. These issues will be discussed in detail in the air section. Additional study during the Remedial Design (RD) for all the soils alternatives will be required to determine the specific impacts resulting from the dredging of the materials from the wetlands.

Another concern is the regrading of those areas of the Site where it is necessary for controlling Site drainage. This regrading presents the possibility of entraining contaminated soils in the air during construction. The clay and topsoil brought in also pose a potential threat of dust generation, both during construction and until the cap is fully vegetated. These cap materials also pose a threat of eroding sediments into the Site's surface waters during the same time period. These potential problems can be avoided and/or mitigated with strict enforcement of conventional dust and sediment control construction practices.

S-3 Cover contaminated soils containing any toxic metal in excess of 100 ppm in place with 6 inches of clay, 18 inches of common borrow, followed by 6 inches of topsoil and establish a vegetative cover.

Alternative S-3 a is source control action similar in design and scope to the previous alternative. The only difference between the two is the thickness of the impermeable barrier. This alternative proposes to use 6 inches of bentonite clay material and 18 inches of common fill instead of the full 24 inches of bentonite clay proposed under S-2. Alternative S-3 would provide a similar degree of protection relative to the direct contact potential; however, it would not provide the same degree of reliability for impermeability as would S-2. The capital and operation and maintenance costs associated with S-3 are summarized in Table 31.

This alternative would meet the established public health response objectives for the Site. The surface cap system would effectively contain the soil/waste material and prevent contaminant migration, and as a result the potential for direct contact and accidental ingestion exposure would be eliminated. Conformance to applicable or relevant and appropriate Federal requirements is the same as that in S-2 and is discussed in more detail in the appropriate section of this document.

The primary advantage of S-3 over S-2 is the substantially lower capital costs, $13.25 million versus $23.6 million. The O&M and monitoring costs are equivalent and as a result the difference in present worth cost is slightly less than $10 million. While S-3 meets the remedial objectives establisned for the Site, the degree of added protection against infiltration under S-3 is substantially less than that for S-2. There are several reasons for this. Quality assurance and in-the-field application of bentonite are critical to ensure that the installation provides the degree of impermeability designed for. Typically, greater thicknesses, such as twenty four inches or greater, placed in several lifts, are necessary to minimize the potential of barrier failure. These failures usually occur as a result of placement, improper compaction or the clay cracking and shrinking as the moisture content comes to equilibrium once in place. Placement of a thicker layer, in three or four discrete lifts, eliminates most of these failures. A six inch thickness, placed in one lift, negates the benefits derived from the multiple lift technique. The resultant effect is the greater potential for infiltration and a lower reliability than in S-2.

The same concerns relative to the adverse impact to the wetland remain for this alternative as for the previous one. Likewise this alternative poses the same short term potential dust and sedimentation problems posed by S-2. Like all capping alternatives, S-3 does not recycle, reuse, minimize or destroy the wastes, and is dependent on perpetual O & M and institutional controls to ensure the efficacy of the remedial action.

S-4 Cover contaminated soils containing any toxic metals in excess of 100 ppm with 24 inches of common fill material, place 6 inches of topsoil and establish a vegetative cover.

Alternative S-4 is a variation on S-2 and S-3, the only difference being that the twenty four inches of fill below the six inches of topsoil is clean borrow material instead of clay or clay and borrow material. As in other alternatives, institutional controls would be implemented as part of the alternative. The capital O&M and monitoring costs of S-4 are located in Table 32.

The use of this cover, even though it is permeable to surface water and rain water infiltration, would meet the established environmental and public health objectives for the Site. Placement of the cover material will effectively prevent the threat to, and provide adequate protection of the public health, welfare and environment resulting from the potential for direct contact. With the exception of compliance with Executive Order 11990, this alternative meets all applicable or relevant and appropriate Federal public health and environmental requirements.

Similar to S-3 and S-2, this alternative does not recycle, reuse, minimize, destroy or eliminate the waste material, only containing it on-site while eliminating the potential for direct contact. As a result, the remedial alternative will require continuing oversight and periodic maintenance indefinitely.

There are no identified Site conditions or waste characteristics that would adversely impact the implementation or construction of this alternative at the Site, other than those discussed under S-2 and S-3.

S-5 Cover contaminated soils with 20 mil PVC synthetic membrane, cover membrane with an additional 12 inches of common fill followed by 6 inches of topsoil and vegetate.

The intent of Alternative S-5 is similar to the previous three alternatives, which is to eliminate the potential for direct contact by placing cover material over the exposed or near surface deposits. Alternative S-5 uses a synthetic membrane instead of soil or clay to establish a protective barrier. Like S-2 through S-4, the pond abutting the East Hide Pile would be drained and filled.

Similar to S-4, S-3 and S-2, areas requiring remedial action under S-5 would receive Site preparation, including recontouring to promote drainage, prior to the cap installation. After this initial step, a six inch cover of screened sand would be compacted over the area. The purpose of the sand is to establish a stable and protective layer between the ground's surface and the synthetic membrane. The membrane, proposed to be 20 mil thick PVC, would then be placed on top of the sand. The membrane is delivered to the site in large rolled panels. Field installation includes placement of the panels and field seaming to join each panel together followed by an in-situ quality control check. Once the membrane has been placed, seamed and tested, it is covered by an additional six inches of sand. This layer of sand serves as a protective cover to prevent puncturing of the membrane and as a mechanism to drain off any moisture in contact with the membrane. The sand layer is followed by twelve inches of fill material and six inches of topsoil. Vegetation is established to control erosion. The additional cover material serves two purposes. First, it adds additional protection to the synthetic cover and second, it provides sufficient depth to minimize the effects of the freeze-thaw cycle.

Since the synthetic membrane is impermeable it provides the same added degree of protection against infiltration as does alternative S-2. The capital, operation and maintenance, and present worth costs are summarized in Table 33.

The implementation of this alternative uses proven engineering techniques. The operation and maintenance requirements are not complex and are similar in nature and scope to those found in Alternatives S-2 thru S-4. The application of Alternative S-5 offers several advantages over the previously discussed alternatives. The constructibility of this alternative is better than those alternatives which use clay to establish impermeability. Because the barrier is a synthetic product, it is manufactured under carefully controlled factory conditions. As a result, the quality and impermeability of the membrane can be more carefully controlled, resulting in an impermeability higher than natural materials. Field placement is easier to perform, less susceptible to inclement weather conditions and changes in the raw product. The disadvantages of using a synthetic material are the possibility of puncturing the liner during placement, the maintenance of quality control over field seaming, and the potential incompatibility of the membrane with the wastes or the susceptibility to attack from chemical contaminants. Another disadvantage of synthetic membranes is that they are relatively new for use in hazardous waste applications. As a result, their useful life has not been documented.

Alternative S-5 is protective of the public health and environment. As in the previous alternatives, minimization of potential for direct contact is the primary objective, and alternative S-5 meets this objective. In addition the installation of a synthetic membrane minimizes the potential of infiltration, thereby providing an additional degree of protection against leaching. It also meets all applicable or relevant and appropriate public health and environmental requirements except for Executive Order # 11990. It also poses most of the same dust and sedimentation concerns posed by the previous three alternatives.

The use of alternative S-5 would effectively contain the waste deposits and prevent future contact or contaminant migration. However the waste material to be capped would not be recycled, reused, minimized or destroyed, and therefore the cap must be maintained and monitored indefinitely since in-situ physical, chemical, biodegradation mechanisms are not expected to reduce the material to a nonhazardous classification. Institutional controls similar to those previously discussed would also be required to prevent disturbance of this remedial alternative.

S-6 Cover contaminated soils in place with six inches of topsoil and vegetate.

Alternative S-6 consists of regrading portions of the Site to promote better drainage. Once the site has been regraded, six inches of topsoil will be placed over those areas where exposed deposits exist. Once the topsoil has been placed a vegetative cover would be established over the entire area. This alternative includes some limited excavation in the northwest corner of the Site along New Boston Street to minimize contact of wastes with the surface water. In addition, actions relative to the West and East Hide Piles (as previously discussed) are incorporated as part of this remedial alternative. The use of institutional controls would be needed in order to ensure that the remedial action was maintained as initially implemented. Capital costs and operation and maintenance expenses associated with this alternative are found in Table 34.

Implementation of alternative S-6 uses conventional and well established technologies. The alternative is relatively easy and straightforward to implement. The alternative is also attractive in that it provides minimum disruption to the local businesses and community during the implementation phase, since less material must be trucked into the Site.

The alternative meets the remedial objectives established for the Site, similar to the previous alternatives, but the degree of reliability is substantially less than those alternatives. The Operation and Maintenance (O&M) costs are higher to compensate for the decreased reliability. These two disadvantages can be related directly to the fact that the effects of the freeze-thaw cycle are much more pronounced on this alternative (six inches of cover material) than those alternatives using thirty inches of cover materials. As a result of only six inches of cover, the frost is permitted to penetrate to the actual waste deposits, thereby forcing wastes to the surface as the ground begins to thaw.

This occurrence significantly increases the potential for exposure of wastes to the public and environment. Another concern is that of erosion. Site conditions and surrounding land use patterns indicate a high potential exists for erosion to occur. The effects of erosion on a six inch cover will obviously pose a greater potential for release of contaminants than on a thirty inch cover. In order to minimize the potential for release occurring, the frequency of monitoring and routine maintenance for a six inch cover needs to be increased, hence an increased O&M cost. A second technique is to select and establish a vegatative cover which enhances the ability of the vegetative cover to minimize erosion. Again, this increases the operation and maintenance costs.

Alternative S-6 is protective of the public health, welfare, and environment since it meets the remedial objective of preventing direct contact with the public and surface water. This alternative has similar status with respect to applicable or relevant and appropriate Federal public health and environmental requirements as the previous alternatives, especially those employing permeable caps. An analysis of S-6 indicates that like the previous four alternatives it is a source control action which contains and controls future impact by using a long term in-situ cover. This alternative does not avail itself of new or innovative technologies. It provides an effective, if somewhat less reliable means of eliminating the potential for direct contact than the preceding alternatives with the exception of S-1. In addition, implementation does not pose any significant adverse environmental impacts over and above those noted in the previous four alternatives.

Alternative S-6 does nothing to recycle, reuse, minimize or destroy the wastes found at the Site. This alternative does not use new, innovative or alternative technologies to reliably minimize either the present or future threats to the public health, welfare or the environment.

S-7 Construct a RCRA on site containment facility. Excavate and deposit into the RCRA facility any waste deposit containing arsenic, chromium, or lead waste with individual concentrations of one or more exceeding 100 ppm, as well as the East Central, the West, and the South Hide Deposits.

Alternative S-7 evaluated the feasibility of excavating and relocating on-site all waste deposits containing heavy metals in excess of 100 ppm and all hide deposits except for the East Hide Pile to a hazardous waste landfill designed in conformance with the Resource Conservation and Recovery Act (RCRA). This would effectively contain Site contamination and prevent future potential migration of contamination associated with the Site. The technical performance of an on-site RCRA landfill is good compared to other containment technologies. A double liner, an impermeable cap, a leachate collection and storage system, and a leak detection system would prevent the migration of contaminants from the landfill. Any leakage through the first liner would be captured by the second liner and would be detected and collected prior to entering the groundwater. The useful life of a properly maintained RCRA landfill would be at least 30 years. The exact service life cannot be accurately predicted. However, the in-effect "triple" liner system would effectively eliminate the potential for release and therefore should provide for long-term waste containment. Site conditions are such that a minimum of ten feet would exist between the base of the landfill and the groundwater table. Long-term groundwater monitoring would also be provided. The various tasks associated with this alternative are indicated on the detailed cost estimate sheet, Table 35. It should be noted that the costs presented are underestimated because they represent the costs for consolidating wastes found on undeveloped property only.

Operation and maintenance requirements for an on-site landfill would be relatively complex. They would include groundwater monitoring, facility inspection and maintenance, and disposal/treatment of any leachate that may be generated from within the landfill.

Land use restrictions would be required for the area of the on-site landfill. No development would be allowed at the landfill site.

This alternative effectively mitigates the threat to, and provides adequate protection of public health and welfare and the environment and achieves the remedial objective for the site. With the exception of compliance with § 404(b) and the Executive Order 11990 this alternative exceeds applicable or relevant and appropriate Federal public health and environmental requirements since it also eliminates any potential for the wastes to leach contaminants into the groundwater. While regulatory permits would not be required implementation of S-7 would meet the technical requirements for new RCRA facilities. The impacts to the wetlands under this, as well as the other consolidation alternatives will be significant. Primary attention has been given to the wetlands located between the East and West Hide Piles; however, several smaller wetlands found on-site would be impacted under the consolidation options. As continually noted throughout the ROD, waste deposits are scattered over a large area often times in direct contact with wetlands and surface waters. Under the consolidation alternatives, the entire Site would be effectively excavated, eliminating existing wetlands and streams in the process. Implementation of the consolidation alternatives would not minimize the impacts to the wetlands it would eliminate them completely. Efforts would be required to compensate or create new wetlands once the proposed remedial action was complete.

Alternative S-7 minimizes area impacted and restricted. It uses more advanced technologies than previous alternatives to contain the wastes and eliminate the present and future threats to the public health or welfare or the environment. The use of a RCRA on-site facility would consolidate the waste deposits scattered over 90 acres to an area approximately 15 acres in size with satellite deposits under existing buildings, unless the buildings were removed. This alternative would result in a net gain in the amount of land not needing use restrictions.

There are several conditions that could adversely impact the implementation or construction of this alternative at the Site. The Site contains a number of existing buildings, roadways, and parking lots. In order for the remedy to be completely effective, waste deposits located under these existing structures would need to be removed in addition to those on the undeveloped portions of the Site. Allowing the wastes to remain in place under the buildings means leaving satellite deposits outside the RCRA containment facility, thus reducing the overall effectiveness of this alternative. From a practical standpoint there is no effective method for removing deposits underneath buildings without destroying or removing the buildings. Irrespective of these increases in the estimated costs, the disruption of existing businesses would also make this a difficult alternative to implement.

Further, while the east side of the Site (east of Commerce Way) appears to meet engineering criteria for the siting of a RCRA landfill, the relatively high groundwater table and a major wetlands adjacent to the proposed facility would adversely impact the implementation of this alternative. A waste compatibility evaluation would also be required during the design of the RCRA landfill to ensure compatibility between the waste deposits and the liner system.

Additional impacts resulting from the implementation of this alternative would include the short term generation of dust, odor and sedimentation problems similar to those noted in previous alternatives. Impacts to the wetlands between the Hide Piles would be similar to those previously mentioned, however the wetlands east of Commerce Way would also be impacted by this alternative. The amount of fill material, such as clay, necessary to construct the RCRA facility would need to imported from off-site. This would place a substantial burden on the local traffic flow patterns (which are currently stretched to capacity now). Implementation of this alternative would require that clean uncontaminated land slated for development would be unavailable for future development as a result of this alternative. In addition to all the adverse impacts resulting from this alternative, the alternative does not recycle, reuse, minimize or destroy the wastes materials.

In addition to the logistical and implementation problems noted above, there are several short term adverse impacts associated with implementation of this alternative. The RI determined that approximately fifteen percent of the sludge deposits are contained within the saturated zone. In addition, local surface waters are found in contact with the waste deposits at several locations. Excavation of the deposits will tend to suspend a portion of the waste material in the ground and surface waters. While engineering technique can be implemented to minimize these potential impacts, the sheer volume of wastes to be excavated in order to successfully implement these alternatives make the potential for a short term release very high.

Further, a significant amount of the material requiring removal as part of these alternatives is the animal glue manufacturing deposits. Past experience with the primary developer (Mark Phillip Trust) indicates that disturbance of these deposits will cause a substantial release of odors. Release of these odors will pose a significant adverse impact to air quality surrounding the Site. Historical information indicates that during active excavation of the hide deposits, the odor emanating from the Site was pervasive throughout the surrounding communities. Continuous complaints of the obnoxious odor, severe headaches and nausea were reported to the State regulatory agencies. Reports of workers becoming physically ill are contained in past reports. Strong public reaction from the recipients of the odor resulted in the Town of Reading suing the developer to cease and desist generating the odors. A number of techniques were experimented with in an effort to control the odor, none of which was successful. In the six years since the active excavation, odors can still be detected under certain circumstances as a result of the disturbance of the deposits. As a result of the adverse impact to the welfare and the strong public resistance, the removal or rearrangement of the hide deposits is not feasible.

S-8 Remove all arsenic, chromium, and lead deposits with individual concentrations of one or more exceeding 100 ppm and consolidate these deposits on the East Central/East Hide deposits areas, backfill excavated areas with clean fill material and cover the East Central and East Hide Deposits with impermeable cover.

The FS evaluated the feasibility of consolidating approximately 90 acres of deposits containing elevated levels of arsenic, chromium, and lead into an approximately 15 acre area on the northern border of the site. Implementation of this alternative involves the removal of approximately 460,000 cubic yards of waste deposits and their consolidation into one large deposit. The consolidated deposit would then be covered with a cap similar in design to that found in alternative S-5. Capital costs, operation and maintenance and present worth costs can be found on Table 36. For the same reasons as were discussed for alternative S-7, these costs are underestimated.

Once completed, Alternative S-8 is protective of the public health, welfare and environment. It eliminates the potential for direct contact between the wastes and the public and surface waters. It will not provide the same degree of protection as the previous alternative, S-7. The advantage of the previous alternative S-7 was that once the waste was removed from the present location it would be placed in a secure RCRA landfill. Under alternative S-8 the waste would be consolidated to an area which presently contains waste deposits. The physical handling of the material and the placement of it on top of existing waste deposits may in fact cause more adverse than beneficial environmental effects. Similar to the animal glue wastes which were not generating substantial odors until some of the deposits were disturbed, creating the East Hide Pile and its subsequent release of odors, the physical relocation and restructuring of the deposits to a new area may create a situation that promotes the potential for increased leaching of the wastes. Implementation would not meet applicable or relevant and appropriate Federal public health and environmental requirements. Implementation of this alternative would have significant adverse impacts on surface water quality, the elimination of a wetlands and the release of an obnoxious odor. In addition, impacts to the wetlands and concerns about compliance with the appropriate requirements are similar to those discussed in S-7.

This alternative has several of the advantages associated with alternative S-7 but without the increased cost of constructing a RCRA facility or of moving Hide Piles. Like S-7 this alternative consolidates the wastes onto a smaller parcel of land (15 acres versus 90 acres), thus minimizing the amount of land that must be maintained, monitored and restricted from development. Because of the reduction in physical size there will be a reduction in O&M costs. In addition this alternative, unlike S-7, would consolidate the contaminated materials on property that is already contaminated. The physical removal of the material and its consolidation onto another portion of the property would use standard earth moving techniques that have proved effective in this kind of operation. This alternative has a substantially lower capital cost and is easier to implement than the previous alternative S-7. The alternative is similar to previous alternatives in that it seeks to control the potential for direct contact potential through containment rather than recycle, reuse, minimize or destroy the waste.

Implementation of this alternative could cause several adverse environmental impacts. The physical removal and relocation of approximately 460,000 cubic yards of waste deposits would impact the local groundwater, surface water, and eliminate several wetlands found on-site. This quantity of material to be moved will require a substantial earthworking effort. Because a substantial portion of the waste materials are in direct contact with ground and surface waters, the heavy equipment will need to intrude into these media in order to remove the wastes and eliminate the direct contact. Despite using every available technique to lessen the impacts to surface and ground waters, nonetheless an impact will occur. In addition, issues similar to those found in alternative S-7 involving excavation under existing structures would be applicable to this alternative. The alternative proposes to backfill the excavated areas with clean fill material. In addition to the large amount of traffic to physically remove the waste deposits for waste consolidation, there would be a significant traffic impact on the surrounding community as a result of the large amount of clean fill required from off-site to backfill the excavated areas.

S-9 Remove all arsenic, chromium, and lead deposits with individual concentrations of one or more exceeding 100 ppm; consolidate on the East Central/West Hide Deposits; and cover the East Central and West Hide Deposits with an impermeable material; and leave excavated areas unfilled.

Alternative S-9 is exactly like alternative S-8 except that the excavated area would not be backfilled with fill material. The primary advantage of this alternative over the previous alternative is a substantal decrease in the capital costs. The capital, operation and maintenance costs and present worth costs of this alternative are summarized in Table 37. Again, for the reasons previously noted, these costs are underestimated.

This alternative could be successfully implemented with the application of standard engineering and construction techniques. Site conditions do not pose any significant adverse impacts to the implementation of this alternative, however the concerns to those noted in alternative S-8 relative to the material under existing structures and impacts to the environment also apply to this alternative.

The primary advantage of this alternative is that it costs approximately half that of alternative S-8 in terms of both money and implementation time. The primary disadvantage to this alternative would be that, without the clean backfill, open excavations up to 15 feet deep would be left behind once the Site remediation was completed. Allowing these excavations to remain is not practicable as they would create an attractive nuisance to area children and would leave the area pock marked by numerous shallow ponds or ditches. On the other hand, the land would be clean and hence developable. These ponds would be no worse to deal with than common development problems like high groundwater or bedrock.

S-10 Fence areas of waste deposits, enforce institutional controls; excavate limited area in northwest corner of site; cover the East Central and West Hide deposits.

Alternative S-10 involves the limited excavation of waste deposits from one of the developed properties, PX Engineering, to eliminate the direct contact between these deposits and the surface water. This excavated material would be transported to the East/West Hide Piles area. The East Central, and East and West Hide Pile areas would be regraded and reshaped to promote better drainage. In addition the South Hide Pile would be relocated to the West Hide Pile area in order to fill low spots and help stabilize side slopes. The area which was reshaped and regraded would be covered with a six inch topsoil cover and vegetative growth established. The remaining deposits would be fenced to prevent unauthorized access, and institutional controls would be enforced throughout the entire site to ensure that the remedial action was not disrupted. The capital, operation and maintenance, and present worth costs are summarized in Table 38.

This alternative may not meet the environmental and public health goals established for the Site. The alternative does not effectively prevent, mitigate, or minimize the threats to, and provide adequate protection of the public health and welfare and the environment.

Presently there exist a number of areas within the Site where exposed deposits present a direct contact threat. Under this alternative the barrier between the waste and the public would be a fence. Past experience at this Site indicates that fencing is ineffective in eliminating entry and the potential for direct contact. In the five years since the initial installation of the fence, the Agency has made repeated attempts to repair damage to the fence resulting from vandalism. Implementation of this alternative would permit the continued release or threat of release to the environment of the waste deposited on the Site.

In addition the presence of exposed deposits creates the possibility of their erosion by precipitation runoff, adversely impacting the surface water and ultimately the groundwater found on-site.

This alternative does not meet the applicable or relevant and appropriate Federal public health and environmental requirements. Because exposed deposits would be allowed to remain in direct contact with surface waters the release or threat of release of contaminants would violate Water Quality Criteria. The initial placement of the East and West Hide Pile in or near a wetlands was in violation of the Clean Waters Act §404(b); leaving them in their current state would continue to violate § 404(b). This alternative is extremely simple to implement because this alternative approaches no action. Because the alternative takes only limited actions, the actions are easily constructed. Unfortunately, as previously stated these actions are ineffective in preventing unauthorized access to the Site; thus the actions have to be considered unreliable.

The capital cost is obviously low since S-10 entails only placing fences around the area after limited consolidation, reworking and capping some portions of the Site.

Alternative S-10 does nothing to recycle, reuse, minimize or destroy the wastes found at the Site. This alternative does not use new, innovative or alternative technologies to reliably minimize either the present or future threats to the public health, welfare or the environment.

Implementation of this alternative, like S-1, does not take additional actions in or near a wetlands. As a result there would be no additional adverse impacts resulting from remedial actions. However, the potential does exist over the long term however, for exposed deposits to impact the local surface water as a result of storm water runoff and erosion. This alternative does nothing to minimize these potential problems.

S-11 Cover all waste deposits with 24 inches of off-site fill, followed by 6 inches of topsoil and establish vegetative cover on waste deposits with arsenic values greater than 300 ppm, lead values greater that 600 ppm, and chromium greater than 1000 ppm. Cover the East Central and the West Hide Deposits. Impose institutional controls on the property.

Alternative S-11 is similar to alternative S-4, with respect to the construction details of the cover, i.e. twenty-four inches of permeable material followed by six inches of topsoil. There are several important differences between this alternative and S-4, as well as the other alternatives. Most notably the action levels have changed from an arbitrarily established value of 100 ppm to values developed in the Endangerment Assessment (EA). In addition, previous alternatives addressed covering any deposit exceeding 100 ppm, irrespective of the depth below grade at which the waste was detected. In S-11 the alternative seeks to eliminate the potential for direct contact with any deposit above the action levels established in the EA that could become exposed as a result of the freeze-thaw cycle or effects from erosion. This objective is accomplished through the use of a permeable cover over deposits exceeding the action level that are within thirty inches of the ground's surface. Institutional controls would be implemented to control any area having deposits exceeding the action levels regardless of depth. For contaminated materials located in areas where buildings, parking lots and roadways currently exist the structure itself would serve as the barrier to eliminate the potential for direct contact. As in other portions of the Site, institutional controls would be implemented to restrict disturbance of the effectiveness of the remedial action. The premise of this alternative is to establish a thirty inch zone of uncontaminated material over the waste deposits to eliminate the potential for direct contact, minimize the effects of the freeze-thaw cycle and help control exposure resulting from erosion.

This alternative, S-11, utilizes remedial action levels established by the EA. A discussion of the action levels can be found in the current Site status section of this document and in Appendices F and G of the FS. In addition to the EA performed as part of the FS, another potentially responsible party (PRP), Monsanto Chemical Company, retained a consultant to independently assess the potential risk posed by the Site. Results from this independent analysis were similar to those found in the FS. Both the EA found in the FS and the independent risk assessment were submitted to the Department of Health and Human Service's Agency for Toxic Substances and Disease Registry (ATSDR) for their review and comment in the form of a Health Assessment. ATSDR's review and interpretation of the data was based on a literature review as well as empirical data gathered from several studies conducted by the Centers for Disease Control (CDC). The values determined to be protective of the public health by ATSDR were similar to those found in the EA and the independent analysis. However ATSDR concluded that safe levels for an industrial setting could be an order of magnitude (factor of ten) higher than those determined to be protective of the public health in a residential neighborhood. As a result, ATSDR concluded that maximum acceptable surface soil residues of 6,000 ppm Arsenic, 10,000 ppm Lead and 30,000 ppm for trivalent Chromium were appropriate for this Site, assuming the exposure was the type to be encountered in an industrial setting.

The Agency reviewed and evaluated ATSDR's Health Assessment and rejected their use of an arbitrary increase by an order of magnitude in projecting safe clean-up levels. As previously noted, if the order of magnitude increase is eliminated, ATSDR's values are similar to those calculated in the FS and Monsanto's risk assessment. The Agency does not believe that final determination of clean-up levels should be based, in a large part, on the projected use of the Site. While a portion of this Site is currently an industrial area, the remainder of the Site receives a fair amount of recreational use. Hunters, berry pickers, and motorcyclists are often discovered using the Site. Under the proposed remedial action a portion of the Site would remain undeveloped and as a result, these activities are likely to continue. Since at least a portion of the Site would remain undeveloped under all but two of the remedial action alternatives and therefore an attractive area for adolescents and others to frequent, it is prudent to assume that the potential for exposure is substantialy higher than if the Site were truly an industrial area. It could reasonably be argued that as the land around the Site becomes more industrialized, the Site would become more attractive for recreational use because open space would be that much rarer in this section of the City. The Agency therefore concludes that the action levels established in the EA, not ASTDR's, are protective of the public health, welfare and environment and provide a greater margin of safety given the uncertainty of future land use patterns around the Site.

In addition, the ATSDR Health Assessment is limited to issues directly related to the protection of public health; it does not address levels protective of the environment. As discussed in the EA and in connection with the no action alternative, the arsenic deposits are phytotoxic at levels as low as 300 ppm. Further, the East Hide Pile has a very sparse vegetative cover despite the fact that the last earth moving there ceased seven years ago. This fact supports the relationship between elevated levels of metals and phytotoxicity.

The associated capital, operation and maintenance, and present worth costs for this alternative can be found in Table 39. The primary advantage of this alternative over S-4 are the lower capital and O&M costs resulting from the decreased area requiring remedial action.

Alternative S-11 meets the environmental and public health goals established for the Site. Present and future potentials for direct contact are eliminated by the installation of a permeable cover and institutional controls. In addition the alternative meets the applicable or relevant and appropriate Federal public health and environmental requirements for the Site.

S-12 **Cover the East-Central and West Hide Deposits and all waste deposits with values greater than 300 ppm arsenic, 600 ppm lead, or 1000 ppm chromium with six six inches of topsoil and vegetate. Impose institutional controls on property.**

Alternative S-12 uses the same action levels and depth criterion as S-11, but replaces the twenty-four inch cover in S-11 with a six inch cover like that used in alternative S-6. Like S-11 institutional controls would be needed to prevent disruption of any deposit exceeding the action levels regardless of the depth at which it is found. Cost evaluation can be found in Table 40. Evaluation in terms of engineering implementation and constructibility is the same as with the preceeding alternative. Alternative S-12 meets the remedial objective for soils contamination since it would effectively eliminate direct public contact with wastes exceeding the action levels. As discussed regarding S-6, the six inch cover is readily constructed using conventional engineering techniques. This alternative would be easier to implement because less land, forty-three acres versus seventy acres, would require covering. The smaller area reduces the amount of topsoil that must be brought to the Site, thereby reducing traffic impacts and disruption of the surrounding community. Implementing this alternative poses no long term adverse environmental impacts and poses only minimal construction related impacts, primarily the potential for generating dusts and causing sedimentation of surface waters. These are easily dealt with.

As with S-6, the thinness of the cover proposed here makes it a less reliable remedial action than the thirty inch covers proposed in other alternatives. The six inch cover would be much more susceptible to disruption by erosion and the freeze-thaw cycle. Since this alternative is a containment action, it does not recycle, reuse, minimize or destroy the wastes and contaminated soils.

This alternative has similar status with respect to applicable or relevant and appropriate Federal public health and environmental requirements as the previous alternatives. Based on its lower reliability and higher action levels this alternative while meeting the remedial objective for soils at the Site is less protective of the public health and the environment than all other alternatives except S-1 and S-10. The capital, operation and maintenance, and present worth costs for this alternative are summarized in Table 40.

S-13 **Remove all arsenic, chromium, and lead waste deposits with individual concentrations of one or more exceeding 100 ppm and remove the East Central, the West, and South Hide Deposits to an off-site location. Backfill excavated areas with clean off site fill material.**

This alternative, S-13, evaluates the off-site disposal alternative. Under this alternative all materials above 100 ppm located on undeveloped land would be excavated and trucked off-site for disposal at a RCRA landfill. The majority of the Site would be effectively cleaned up and the wastes disposed of at an off-site RCRA landfill.

The costs of this alternative are presented on Table 41. The associated capital costs are approximately 210 million dollars. Detailed evaluation was not conducted in the FS because its costs far exceed those of the other alternatives without substantially increasing the protection of the public health and environment. Since there are other alternatives that meet the remedial objective and the requirements of other Federal public health and environmental requirements, this alternative is not substantially more effective than other viable alternatives. This alternative is substantially more reliable than other alternatives as evidenced by there being no operation and maintenance costs or institutional controls associated with it. For this reason the Agency will analyze this alternative here.

This alternative is constructable, but the implementation time is extremely long. The FS estimated that it would take approximately seven years of constant soil removal to effectively remove this amount of material. This would severely disrupt traffic and businesses around the Site.

In order for these alternatives to be completely effective, all the waste deposits would need to be excavated and redeposited into a secure facility. This alternative was evaluated in terms of excavating and removing wastes from undeveloped portions of the property. Areas containing buildings, parking lots or roadways were not included as part of this alternative for reasons noted previously. The physical problems and logistics associated with waste removal from under these structures is costly and impractical. Assuming that these deposits are allowed to remain in place, the effectiveness and driving force behind this alternative is substantially reduced.

If all deposits are to be removed, these buildings would have to be taken down, parking lots and lawns excavated and the wastes removed. As a result, a complete removal would cost more than the $210 million estimated in the FS.

The logistical and odor problems discussed previously in connection with alternative S-8 apply to this alternative as well.

This alternative would effectively eliminate any long term public health, welfare, or environmental impacts through the removal of the waste deposits to an off-site facility.

D. Development and Screening of Alternatives for Air

The remedial actions required to abate air problems center around the East and West Hide Piles.

The East and West Hide Piles are large mounds of glue manufacturing wastes and heavy metal sludges that are built out from the sides of hills on the east and west sides of a pond located in the northwest section of the Site. The piles extend from the hillsides across a wetlands and into the pond itself.

The West Hide Pile is relatively stable and is almost entirely covered with vegetation, primarily reeds. There are exposed metals deposits on the West Hide Pile at the base of the slope where it meets the pond. The East Hide Pile is larger, has unstable side slopes and has almost no vegetation covering it.

Sections of the East Hide Pile have sloughed off into the wetlands, simultaneously releasing strong, obnoxious odors. The RI determined that the East Hide Pile is the source of the odors emanating from the Site. It also has several intermittent leachate seeps that impact the wetland.

Since the RI determined that the West Hide Pile was not an odor source, the remedial objectives for this pile are to maintain stable side slopes and to eliminate the potential for direct contact. Therefore, the West Hide Pile remedial action alternatives were evaluated as part of the Soils section of the FS.

The remedial action objectives for the East Hide Pile are:

1) to eliminate the potential for direct contact with the heavy metal wastes;

2) to stabilize the side slopes in order to eliminate sloughing of materials into the wetlands, and
3) to eliminate the emission of obnoxious odor into the ambient air.

For convenience, the RI/FS discussed all the problems with the East Hide Pile as "odor" problems. Similarly, this document will discuss all the remedial alternatives for this problem as "air" alternatives.

The evaluation of the potential air remediation techniques consisted of two parts. The first was an evaluation of various techniques to stabilize the side slopes, to eliminate the potential for direct contact and collect the odorous gases. The second evaluated several treatment techniques which would either eliminate the potential generation of gases or treat the gases being released to the environment. Listed below are the alternatives initially screened for potential use at the Site.

AIR ALTERNATIVES

- No Action

Gas Collection and Control Alternatives

- Construct a passive gas collection system
- Construct an active gas collection system
- Installation of a tall stack
- Construction of a cap system consisting of either an impermeable membrane liner, clays, soil admixtures, asphalts, or urea-formaldehyde materials.

Gas Treatment Alternatives

- Vapor Phase Adsorption
- Carbon adsorption treatment system
- Ion exchange resin treatment system
- Thermal Oxidation
- Installation of flare or afterburner
- Stabilization
- A pH adjustment using sodium bicarbonate or lime to expedite the transition of the East Hide Pile from an active to passive emission source
- Chemical Oxidation
- Addition of hydrogen peroxide or ozone to reduce odor emission

Each alternative was evaluated for its ability to either contain and control the gaseous emission or eliminate the formation of the odor in the first place. The following is a brief discussion of each alternative.

The use of urea-formaldehyde barriers to contain the gaseous emissions was evaluated and eliminated based on acceptable engineering practices. The use of foam to eliminate exfiltration of gases is dependent on its permeability. A review of available information indicated that the effective permeability of the foam varied widely as a result of frequently encountered installation problems.

The use of a tall stack dispersion as a technique was eliminated based on effectiveness. The location of several major high power electrical transmission lines makes the placement of a tall stack in close proximity to the lines infeasible. Furthermore, the use of a tall stack would not prevent or eliminate the release of odors; it would minimize their impacts through enhanced dispersion. While there are advantages to maximizing the dispersion and resulting assimilation of a plume into the environment, enhanced dispersion techniques are not recognized by DEQE or EPA as good engineering practice since they do not reduce pollutant mass.

The use of chemical oxidation to eliminate odors was eliminated based on effectiveness. The use of an oxidizer, such as hydrogen peroxide or ozone, has the potential for generating a hazardous waste as a byproduct of the reaction. This is because the oxidation reactions frequently are not complete, leaving an oxidation product which could be in a more toxic form than the initial compound which would create a significant adverse environmental impact.

Ion exchange as a treatment technique for odors was eliminated based on acceptable engineering practices because it is not an appropriate technique for the treatment of the type of air emissions found at the Site.

The physical removal of the East and West Pile was eliminated based on cost, acceptable engineering practices and effectiveness. The East Hide Pile, determined to be the primary source of odors, was created from the relocation of other hide deposits on-site during Site development. During the excavation of several building foundations, the odor was at its worst. Numerous techniques were implemented to attempt to reduce the odor while still permitting Site development. All efforts to contain odors during excavation and removal failed. Since on-site activities have ceased, the odors have abated significantly, only being detected when one of several conditions, such as changes in barometric pressure, occur. The costs associated with removal of the pile far exceed the costs of other alternatives evaluated ($36 million versus $2.8 million) and the alternative does not provide substantially greater public health or environmental protection. Excavation and removal of the piles would destroy a wetlands during the actual removal. In addition, a substantial impact to the abutting surface water would occur causing serious sedimentation and degradation of water quality. Currently there are no acceptable engineering technologies capable of controlling the release of odors during the excavation of these materials. As a result, there would be a significant release of odors. Workers involved in the excavation and removal would be exposed to concentrations of hydrogen sulfide and methane gases in excess of allowable occupational exposures. Therefore there are no acceptable engineering practices for avoiding these adverse environmental and occupational problems.

The use of lime or sodium bicarbonate as a stabilization technique received an initial evaluation. The technique would involve the injection of a solution into the pile which would raise the pH to a level which would stop the microbial decomposition, a major factor in the generation of odor. The use of this technique was eliminated based on effectiveness. Like grout curtain wells, injection of a stabilization slurry is highly dependent on waste material characteristics and the number and location of the injection points. In addition, use of this technique has not proven effective in reducing emission rates from sanitary landfills.

E. Detailed Analysis of Air Alternatives

Six alternatives, including the no action and total removal alternatives, remained after the initial screening process and were evaluated in detail for use at the Site. The remaining alternatives were subjected to a detailed analysis consistent with § 300.68(h) of the NCP.

Again, for ease of reading, the alternatives as discussed in this document will be renumbered from those found in the RI/FS. The changes are summarized below:

New Number	Old number found in RI/FS
A-1 Shall be considered the No Action Alternative	Not specifically addressed in FS as a discrete remedial action
A-2	Alternative I page 43
A-3	Alternative II page 43
A-4	Alternative III page 43
A-5	Odor Control portion of alternative V located in Appendix I.
A-6	Odor Control portion of Alternative II listed in Appendix I.

A-1 No Action Alternative.

Similar to the alternatives evaluation for groundwater and soils, a no action alternative for air was not specifically addressed in the FS. As a result, a brief analysis of this alternative is summarized here.

The emission of obnoxious odors caused by hydrogen sulfide (H_2S) and other reduced sulfur compounds resulting from the anaerobic decomposition of the glue wastes has been a continual source of disturbance to the neighboring communities and has thus been viewed as posing an adverse impact to their welfare.

In the course of the RI it was determined that the odor threshold for H_2S was between 0.02-0.15 ppm for ambient conditions. Based on air modelling conditions found in Appendix C of the FS, it was calculated that H_2S concentrations found at the nearest residential area under worst case conditions would approach 0.187 ppm. Even at three kilometers downwind of the Site under current conditions (i.e., no excavation), H_2S concentrations would exceed the lower detection level, allowing odors to impact the public welfare.

Implementation of the no action alternative (A-1) would have no capital costs associated with it. The FS estimated $18,000 per year for a quarterly air monitoring program, resulting in a present worth cost of approximately $171,000. If implemented the alternative would permit the East Hide Pile to continue emitting obnoxious odors containing H_2S. In addition to the emission of odors, the physical disposition of the East Pile causes several additional impacts. The pile was initially placed in a wetlands and as the pile increased in size, it further encroached on the pond and its associated wetlands. Presently the pile has unstable side slopes which result in occasional sloughing of contaminants into the pond and adjacent stream. In addition, as a result of inadequate cover material, precipitation continues to percolate through the pile causing leachate breakouts to impact the local surface water. These leachate breakouts were observed following rainfall events and were sampled as part of the RI. While analysis of surface water exiting the pond conducted as part of the RI does not indicate a significant adverse impact, clearly the potential for future impacts exists as the pile continues to decompose, causing additional contaminants to be released to the wetlands.

Because of the previously mentioned lack of adequate vegetative cover, large erosion gullies are evident on the sides of the pile, as the slopes moderate, the displaced soils begin to form deltas in the wetlands. Together with the decomposition of the organic matter in the pile this erosion is a contributing factor to the sloughing of material into the wetland.
The implementation of this alternative is simple and straightforward as it only requires development and implementation of a monitoring program.

This alternative does not meet the applicable or relevant and appropriate Federal public health and environmental requirements. Continued leaching and sloughing of the pile would further impact surface water quality and the wetlands in violation of the Federal Clean Waters Act (CWA). Furthermore, the NCP permits that State standards can be considered by the Agency in selecting remedies at Superfund Sites. The Agency believes that in this instance the Massachusetts Regulations for the Control of Air Pollution, and specifically its regulation (310 CMR 7.09) prohibiting the release of odors into the ambient air is both relevant and appropriate for use at this Site. (The reader is referred to the section on Consistency with Other Environmental Regulations for more detail supporting this decision). As previously discussed, the pile continues to release odors even when there has been no excavation or sloughing occurring at the time.

It is important to note here that under the terms of their Consent Order, Stauffer Chemical Company, the Agency and DEQE have agreed that "odors originating on the Site... shall be deemed and addressed in the same manner as 'Hazardous Substances'" as defined by CERCLA. It is also important to note that under the existing § 106 Administrative Order, Stauffer is obligated to treat the odors as hazardous substances and is obligated to implement or reimburse the Government for the costs of remedial actions to abate the odors.

Selection of the no action alternative would continue to permit odors to be released impacting the environment and the surrounding community's welfare. Continued leaching and sloughing of the pile would further impact the wetlands. The no action alternative does not involve any techniques which minimize, degrade or recycle the waste.

A-2 Dewatering, slope modification, installation of synthetic membrane, topsoil and vegetation.

Alternative S-2 utilizes several standard engineering techniques to stabilize the pile and reduce the odor potential. Specifically, A-2 would reduce the mounded groundwater table within the pile using two methods. The first involves installing a 60 inch drainage system to dewater the pond and depress the local groundwater table. Once drained the pond and associated lowlands would be filled in order to establish a base for slope modification and recontouring. Clean fill and fill from the South Hide Pile will be used to establish a three to one side slope on the pile. Recontouring and shaping of the original pile would be kept to a minimum in order to minimize the release of odors. Following the stabilization of the pile, a six-inch layer of sand, which will serve as a bedding layer, will be placed over the pile. A 20 mil thick PVC synthetic membrane will be placed to form a cover impermeable to gases and liquids over the waste deposit. This synthetic membrane is the second step to reduce the mounded groundwater table within the pile. On top of the membrane another six inches of sand followed by six inches of topsoil will be placed to complete the remedial action. A vegetative cover and surface water control and diversion structures will also be included as part of the cover design.

The RI determined that the generation of odors is controlled by five factors: moisture contained within the pile, anaerobic decomposition of the organic material within the pile, sloughing of side slopes, gas migration via pore spaces, and rapid changes in barometric pressure. A-2 seeks to control four of the five factors by dewatering the pile, utilizing the synthetic membrane to prevent gas migration and precipitation infiltration, lowering the local groundwater table by dewatering the pond, and stabilizing the side slopes to prevent sloughing. A-2 does not involve any gas venting and/or treatment system, nor does it attempt to prevent decomposition of the wastes. The capital, operation and maintenance and present worth costs are summarized in Table 44.

This alternative meets the environmental and public health goals for the Site by reducing the potential for direct contact, odor generation and degradation of the wetlands and surface waters. The techniques used to obtain these objectives involve standard civil engineering techniques and have an expected useful life of 50 years. Operation and maintenance costs and efforts are similar to those involving soil capping alternatives. There is nothing in the characteristics of the wastes which would adversely impact the alternative.

Results of the RI indicate that the air emissions from the East Hide Pile are adversely impacting the ambient air quality at and around the Site, but are not currently presenting a threat to public health and the environment. The continued emission of the H_2S and the other reduced sulfur compounds, with their attendant odors, are adversely impacting the public welfare. In addition to eliminating the potential for direct contact and the impacts to the surface water the remedial actions taken to abate the odors would also be addressing a threat to the public welfare.

Alternative A-2 does not propose remedial actions to actively eliminate the potential release of odors. Under this alternative, elimination of odor potential relies on elimination of moisture to interrupt the anaerobic decomposition cycle and on the impermeable cap to trap the gases that are generated. Since it is difficult to predict the relative importance of each factor in the release of odor, the elimination of moisture from the pile may not provide the degree of reliability necessary to eliminate the odor. Further the synthetic liner, while impermeable to the gases, will be tied into relatively permeable materials at the base of the pile. Trapped gases may escape into the ambient air via this pathway. Elimination of the odor's adverse impacts on the welfare of the surrounding community is considered a major component to the successful resolution of the Site's problems.

This alternative does not use recycling, reduction or destruction as a technique to minimize or eliminate the problems. The alternative uses containment and monitoring as the means to achieve the remedial objectives. Implementation of this alternative would also produce an adverse environmental impact. Under this alternative the FS indicates that the abutting wetlands would need to be drained and filled as part of the remedial plan. The elimination of wetlands is prohibited under both § 404(b) of CWA and Executive Order 11990 unless it can be shown that no other practical alternative exists. In the event that a wetlands requires filling, mitigation techniques must be implemented to compensate for the eliminated wetlands. The FS indicates that a substantial portion of the groundwater mound results from the high groundwater table and artesian-like conditions within the pile. Lowering the localized groundwater table by draining the wetlands will reduce this mound. The remaining reduction will result from the synthetic membrane. In addition, the FS concluded that the drainage of the wetlands was necessary in order to establish a good base for building the necessary three to one side slopes.

The alternative uses standard engineering practices in implementation of the remedial action. Implementing it is simple and straightforward. Care must be taken in field seaming the synthetic membrane and in checking the integrity of the installed membrane.

The overriding disadvantage of this alternative is that it destroys the wetlands. A second disadvantage would be the possible failure of the membrane resulting from gas pressure building up beneath it, rupturing the liner. Another possible disadvantage is that even if the membrane does not rupture the pressurized gases may travel laterally out from under the edges of the membrane and ultimately enter the ambient atomsphere.

A-3 Dewatering, slope modification, installation of synthetic membrane, gas collection and treatment utilizing carbon adsorption, topsoil and vegetate.

A-3 is exactly like A-2 except that A-3 includes installing a gas collection and treatment system.

Prior to the installation of the synthetic liner a gas collection system consisting of a series of six inch diameter PVC pipes bedded in a twelve inch layer of gravel will be installed. These pipes will be manifolded together to form a header pipe which is connected to a blower system. The blower system discharges into the influent of a treatment system. The treatment system proposed in A-3 consists of two stainless steel tanks connected in series containing activated carbon. The odor containing air would be passed through an activated carbon filter especially treated to remove H_2S and mercaptans. The use of a specially treated activated carbon makes this an effective technique. The effectiveness of carbon adsorption is dependent upon the polarity of the compounds to be removed. For example, nonpolar organics such as benzene adsorb well. Hydrogen sulfide, however, is polar and as a result, tends to be absorbed well on standard activated carbon. The removal efficiency of carbon adsorption for hydrogen sulfide can be increased by impregnating the carbon with metal oxides. Several types of carbon can be used dependent on influent conditions. A Calgon metal impregnated activated carbon, specially formulated for H_2S and mercaptan adsorption in oxygen free atmoshperes, Type FCA, could be used to adsorb emissions from a passive gas vent. However, the low emission rate would not ensure equal distribution through the carbon, increasing the likelihood of early odor breakthrough. Therefore, a passive venting system is unsuitable for carbon adsorption.

Another type of Calgon carbon specially treated for H_2S and mercaptan adsorption in the presence of oxygen, Type IVP, could be used with an active venting system. Introduction of air would ensure good distribution through the carbon bed thereby prolonging the useful life of the system, reducing methane concentrations below the 5-15 percent explosive range, and providing the oxygen atmosphere required for IVP adsorption. Carbon may also act as a catalyst to oxidize hydrogen sulfide. Selection of the most appropriate type of carbon, sizing of the system and other operating parameters will need to be defined as part of the remedial design.

The effluent from the carbon treatment would be vented to the atmosphere. If activated carbon treatment is chosen to remove H_2S, mercaptans, and volatile organic compounds (VOC) from the East Hide Pile, a monitoring plan should be developed in the design phase to determine when breakthrough occurs. This will ensure that the carbon is replaced before obnoxious odors and elevated amounts of VOCs are emitted from the adsorber. The remainder of this alternative would be the same as A-2.

Capital, operation and maintenance, and present worth costs are summarized in Table 45.

Similar to A-2 this alternative uses standard engineering applications to meet the stated objectives. The use of an activated carbon treatment system is a well proven technique which will effectively capture the H_2S, mercaptans and low levels of volatile organics contained in the air emissions. As a result the treatment technology effectively eliminates the potential adverse impacts from air emissions.

Alternative A-3 achieves the remedial objectives established for the East Hide Pile. Active collection and treatment system will effectively eliminate any additional impact to the public welfare, as discussed in connection with Alternative A-2. releases. Stabilizing and covering the pile with an impermeable membrane will eliminate the potential for direct public contact with the wastes, will protect the surface waters from the effects of sloughing and sedimentation, thus protecting the surface water quality from being degraded.

This alternative does not meet or exceed all the applicable or relevant and appropriate regulations because of the filling of the wetlands. It will meet or exceed the applicable or relevant and appropriate Federal and State requirements for the eliminate of gaseous emissions, specifically odor.

The treatment system will not reduce, recycle or degrade the actual source creating the odor. As a result, the remedial action will require O&M and monitoring until natural degradation of the wastes is completed. Once the remedial action under this alternative begins, the length of time for the pile to come into equilibrium cannot be predicted.

A-4 Dewatering, slope stabilization, gas collection and treatment utilizing thermal oxidation followed by installation of 20 mil PVC synthetic membrane, cap with topsoil and vegetation.

This alternative is similar to A-3 except for the treatment method used to eliminate odors. Because methane gas, a combustible gas, is a principal component of the pile's emissions, thermal oxidation is a feasible alternative. The RI measured emission rates from various locations within the pile over time. These rates varied depending on weather conditions, time of year and amount of recent precipitation. Based on data collected, the FS screened various treatment scenarios based on the emission rates of gases from the East Hide Pile. The FS concluded that either the treatment system proposed in alternative A-3 or the one proposed in this alternative would be equally effective in meeting the established remedial objectives. The primary difference in selection of either alternative A-3 or alternative A-4 is one of cost-effectiveness. The FS concluded that alternative A-3 was more cost effective in removing the odors than alternative A-4 if the rate of gaseous emissions remained relatively low. If however, the emission rate exceeded 2 actual cubic feet per minute (ACFM) then alternative A-4 was more cost effective than than alternative A-3. The treatment system proposed under this alternative consists of a small pre-manufactured incinerator unit using liquid propane as a supplemental fuel to maintain an exit temperature between 1,400-1,600 °F. At these temperatures the H_2S would be thermally oxidized.

Since A-4 differs from A-3 only in its substitution of incineration for carbon adsorption as the gas treatment system and since the two treatment systems are equally effective, A-4 also meets the remedial objectives for the Site.

The alternative uses well proven technologies to implement the remedial action. The use of a small commercially available incinerator makes the implementation of this alternative simple and straight forward. As such, the alternative presents no significant engineering or implementation problems and would provide a high degree of reliability. All other construction details are the same as evaluated in A-3.

The use of this alternative would pose the same impacts and concerns as the previous Alternative, A-3, including destroying the wetland. Thus A-4 meets the applicable or relevant and appropriate Federal public health and environmental requirements for air but not for wetlands. Since the alternative uses incineration, the H_2S would be converted into SO_2. The FS estimated that SO_2 emissions would be well below the established

Massachusetts Primary and Secondary Ambient Air Standards, developed in conformance with the Federal Clean Air Act (CAA). If thermal oxidation is chosen to remove H_2S, mercaptans, and VOCs from the East Hide Pile, a sampling and analysis plan should be developed in the design phase for SO_2, particulates, toxics, and VOCs to ensure the safety of the public and to ensure that the National Ambient Air Quality Standards (NAAQS) are not exceeded.

This alternative does not recycle, reuse, minimize or destroy the wastes.

A-5 Complete excavation and removal of the East Hide Pile, contain material in an on-site RCRA landfill, gas treatment.

Alternative A-5 involves the excavation of the entire East Hide Pile and relocation to an on-Site RCRA landfill. This alternative was initially discussed as part of the S-7 alternative for remediating soils contaminants. The capital, operation and maintenance and present worth costs associated with this alternative are found in Table 47.

While the East Hide Pile could be excavated and transported simply and directly to the new facility, the operation is infeasible because of the intense short term adverse impacts caused by the action itself. As stated previously, any disturbance of these deposits releases a strong pungent and obnoxious odor, creating a situation which would not be tolerated by either the construction workers, area businesses or the neighboring community. Also noted eariler, in spite of numerous experiments, no way of excavating these materials without generating odors was ever found. As a result, the need to physically remove the piles in order to protect the public health, welfare and environment is unwarranted given these adverse impacts and attendant violations of DEQE air regulations.

In addition to the adverse air impacts, implementing this alternative would significantly impact the abutting surface waters and wetlands. In the previous alternatives, the need to drain and fill the pond in order to depress the local groundwater table was an integral part of the proposed remedial action. Under this alternative, once the pile was removed there would not be a need for groundwater table adjustment and as a result, at least in theory, the pond and associated wetlands would not be impacted. As a practical matter there would a substantial adverse impact to the local surface waters and wetlands resulting from this alternative. As stated throughout this document, the East Hide Pile is physcially located in and next to the pond and wetlands. The physical size and location of the pile would require a substantial earthmoving effort in order to accomplish the relocation to the on-Site RCRA facility. Access and egress roads would need to be constructed in order to be able to effectively remove the deposits. A major portion of these roads would be located in the wetlands, around the pile and in parts of the pond, effectively destroying the wetlands and pond. In addition, sedimentation and erosion control would be a major concern for those portions of the wetlands and pond remaining.

This alternative does not effectively involve the reuse, recycling, minimization or destruction of the wastes, rather it seeks to eliminate the present and future potential threats to the public health and environment through the use of containment techniques.

A-6 Complete excavation and off-site removal of East Hide Pile to a RCRA approved facility.

Alternative A-6 was evaluated as part of the screening process. The alternative did not receive a detailed analysis because the FS screened it out. However, it is included and briefly discussed here as a benchmark for the upper range of remedial actions. Alternative A-6 involved the excavation and off-site disposal of the East Hide Pile. The waste would be transported to an approved RCRA landfill for disposal. The capital costs associated with this alternative are $35.86 million.

The public health and environmental impacts of this alternative are similar to those previously outlined in alternative A-5.

F. Development and Screening of Groundwater Alternatives

Two plumes of contaminated groundwater were detected in the southeastern portion of the Site during the Phase II remedial investigation. The plumes, of unknown origin, containing volatile organic compounds (benzene and toluene) have migrated off-site and if left untreated would ultimately impact the Wells G&H aquifer that yielded water to the former municipal water supply wells. The FS evaluated a number of alternatives to minimize or eliminate the present and future potential impacts to the public health, welfare and environment resulting from these plumes. Listed below are the alternatives initially screened pursuant to § 300.68(g) of the NCP.

GROUNDWATER ALTERNATIVES

- No Action

Groundwater Interception/Recovery

- Slurry wall around Site perimeter tied into possible underlying confining strata.
- Slurry wall at north end of Site tied into possible underlying confining strata.

- Slurry wall across southern boundary of Site tied into possible underlying confining strata.
- Slurry wall across southern boundary of Site and along East and West Site boundaries, south of hide piles to mid Site and tied into possible underlying confining strata.
- Slurry wall around detected groundwater plume near wells OW-12 and SD-55.
- Slurry wall across northern boundary and southern boundary of the Site tied into possible underlying confining strata.
- Grout curtain around entire Site anchored in bedrock.
- Grout curtain across northern boundary of Site anchored in bedrock.
- Grout curtain across southern boundary of Site anchored in bedrock.
- Grout curtain across southern and northern boundaries anchored in bedrock.
- Grout curtain around detected groundwater plume near wells OW-12 and SD-55.
- Bottom seal under entire Site by injection of a grout curtain base layer.
- Pump groundwater via recovery well system along entire perimeter of the Site.
- Pump groundwater via recovery well system along northern boundary of the Site.
- Pump groundwater via recovery well system along southern boundary of the Site.
- Pump groundwater via recovery well system in the vicinity of the detected groundwater plume near wells OW-12, SD-55, and OW-6.
- Pump groundwater via recovery well system along the northern and southern boundaries of the Site.
- Construct interception trench along northern boundary of Site between East/West Hide Piles and wetlands.
- Construct interception trench along northern and southern boundary of Site.
- Construct interception trench along southern boundary of Site.
- Construct interception trenches downgradient of detected contaminant plumes near wells OW-12 and-55.

Groundwater Treatment

- Treat recovered groundwater with air stripping column for VOC removal.
- Treat recovered groundwater with granular activated carbon (GAC) columns for removal of adsorbable organic compounds.
- Treat recovered groundwater with powdered activated carbon (PAC) for removal of adsorbable organic compounds.
- Treat recovered groundwater with oxidizing agent for odor destruction.
- Treat recovered groundwater with ion exchange resins for cation and anion removal.
- Treat recovered groundwater with suspended or attached growth biological reactors for removal of biochemical oxygen demand (BOD)
- Treat recovered groundwater with air stripping column and with PAC.
- Treat recovered groundwater with reverse osmosis for multi-compound removal.
- Treat recovered groundwater with pH adjustment/precipitation-flocculation/sedimentation for metals removal.
- Install permeable treatment beds (GAC) downgradient of East and West Hide Piles.
- Install permeable treatment beds (GAC) downgradient of wells OW-12 and SD-55.
- Install permeable treatment beds (GAC) along downgradient boundary of Site.

Groundwater Discharge

- Direct discharge to MDC sewer.
- Treatment, discharge to MDC sewer.
- Direct discharge to downgradient surface water body.
- Treatment, discharge to downgradient surface water body.
- Treatment, recharge to the Site substratum.

Alternatives capable of eliminating or minimizing the impact to the aquifer resulting from the organics plume were subjected to an initial screening broke into three sections; groundwater interception/recovery, groundwater treatment and discharge of groundwater to the environment.

The use of containment barriers, slurry walls or grout curtains both with and without groundwater pumping were evaluated for application at the Site. Various combinations of these techniques were evaluated. The intent of containment technique is to control and contain either the contaminant itself or the upgradient groundwater so that the contaminant can be pumped from the aquifer in the most efficient manner without inducing a large amount of uncontaminated groundwater into the collection system. The effectiveness of this technique is largely dependent on the ability to seal the containing structure against an impermeable layer, such as bedrock or till. Geologic conditions at the Site make implementation of this technology difficult. The bedrock to the east, west, and south of the Site is pervasively fractured, permeable and dips steeply. As a result, it would not be suitable as an impermeable layer into which to tie a barrier. In addition, the Agency has found that slurry walls tend to leak, allowing contaminants to be continued to be released to the environment. Slurry walls, therefore, will not meet the groundwater clean-up objective. For these reasons containment barriers were excluded from additional consideration.

Water table adjustment to minimize groundwater flow through the waste deposits was subject to the initial screening process. This alternative uses either interceptor wells to extract groundwater or subsurface drains to depress the level of groundwater below the waste deposit. Diverting the groundwater below the deposit greatly reduces the leaching potential. The technique remains effective so long as there is continued extraction of groundwater at a sufficient rate to keep the groundwater table depressed. This technique is usually used in conjunction with impermeable cover to eliminate the effects of precipitation.

The water table adjustment technique is most efficient when the source of the groundwater plume is fairly large, in contact with the groundwater and will continue to leach into the groundwater if allowed to remain. Maximum effectiveness then occurs when low pumping rates produce a significant lowering of the water table. Neither case is found on-site. The RI investigation failed to locate a source of the organics impacting the groundwater. In order to make this technique effective, an impermeable cover would need to be placed over the entire Site in order to reduce the amount of precipitation leaching organics into the groundwater. Site conditions and the nature and extent of the plumes cause this technique to be excluded from further consideration based on acceptable engineering practices.

The next component of the screening process was the evaluation of possible treatment alternatives. The FS screened twelve groundwater treatment processes for possible use at the Site. These twelve processes were evaluated as unit operations capable of being combined in some manner to form a treatment system which would effectively treat the contaminated groundwater. As a result, the initial screening focused more on the use of specific technologies to treat contaminants than discrete and complete treatment systems. The detailed analysis of groundwater alternatives does address complete treatment systems and not unit processes. Of the twelve unit processes initially screened, four were eliminated from further consideration. The reasons why they were excluded are summarized below.

Treatment of the recovered groundwater with ion exchange resins was evaluated and excluded based on cost and acceptable engineering practices. The use of ion exchange resins is particularly effective for the metals and considerably less effective for volatile organic compounds such as those found in the groundwater on-site. Because the primary contaminants of concern are volatile organics and not metals, the application of ion exchange is not effective.

Treatment of the groundwater using reverse osmosis was also evaluated. Osmosis is the flow of a solvent (e.g., water) from a dilute solution through a semipermeable membrane (dissolved contaminants permeate at a much slower rate) to a more concentrated solution. Reverse osmosis is the application of sufficient pressure to the concentrated solution to overcome the osmotic pressure and force the net flow of water through the membrane toward the dilute phase. This allows the concentration of solute (contaminants) to build up on the one side of the membrane while relatively pure water is transported through the membrane. Ions and small molecules in solution can be separated from water by this technique.

The basic components of a reverse osmosis unit are the membrane, a membrane support structure, a containing vessel, and a high pressure pump. The membrane and membrane support structure are the most critical elements.

The use of reverse osmosis is usually limited to polishing low flow waste streams containing high concentrations of contaminants. Because reverse osmosis is extremely sensitive to fouling, plugging and chemical attack, it requires extensive pretreatment and careful operation to ensure effective removal. Because of these concerns and associated costs, the FS excluded reverse osmosis from further consideration based on acceptable engineering practices and cost.

The use of powdered activated carbon (PAC) was evaluated as was granular activated carbon (GAC). GAC was retained for further evaluation, but PAC was eliminated because it did not offer an increase in environmental effectiveness but did have higher operation and maintenance (O&M) costs associated with it.

At sites where the contaminated groundwater is relatively shallow, the use of permeable treatment beds may be an effective method to intercept and treat the groundwater. The beds are built by excavating a trench downgradient of and perpendicular to the flow of contaminated groundwater and backfilling it with a media which is capable of either chemically or physically removing the contaminant. The use of this technology was rejected for use at the Site based on acceptable engineering practices and effectiveness. The permeable treatment beds are subject to plugging, saturation of the media, and short circuiting. As a result he beds would not provide the long term treatment or reliability necessary to ensure effective removal of the contaminants.

The last component evaluated during the screening of groundwater alternatives was the discharge of the treated effluent. Each alternative was evaluated for acceptable engineering practices, effectiveness and costs. Differences in cost was not a significant factor for this portion of the evaluation.

The first alternative evaluated was the discharge of the treated effluent to the Metropolitan District Commission (MDC) sewer. A major MDC interceptor sewer line is located on-site paralleling the train tracks. The FS evaluated the feasibility of this alternative but rejected it based on effectiveness. Several factors serve as the basis for its rejection. First, the MDC regulations prohibit the discharge of groundwater into its system. More importantly is the fact the MDC operates a regional system of which only a relatively small percentage of the wastes received treatment. This small percentage receives primary treatment prior to discharge into Boston Harbor. Primary treatment is ineffective in removing the contaminants of concern. Finally the system is old, in various states of disrepair and generally overloaded. During a major storm event, many of the system's sewer lines surcharge, dumping untreated waste into the surrounding environment. Even though the anticipated discharge would be an insignificant portion of the total flow handled by the system, the alternative does little to effectively contribute to the protection of public health and welfare and the environment.

The FS evaluated the disposal of the treated effluent by recharging it to the aquifer using a trench or leachfield. This alternative is unsuitable for use in situations involving large quantities of treated effluent, except in limited applications.

The aquifer in the general Site area is relatively shallow. As a result the aquifer has a limited capacity to accept the introduction of large quantities of water over a short period of time. Any discharge from a treatment system would be limited to approximately 50-100 gallons per minute (gpm). Quantities in excess of these values would cause ponding and flooding to occur.

The anticipated discharges from the treatment plants are projected to be greater than the ability of the aquifer to assimilate the discharge; as a result, this alternative was dropped from further consideration, based on acceptable engineering practices.

Discharge to the aquifer downgradient of the Site via an injection well was rejected for same reasons.

G. Detailed Analysis for Groundwater Alternatives

The FS retained three alternatives for detailed evaluation involving remediation of the groundwater. The alternatives, labelled GW-2, GW-3 and GW-4 involve various interception, treatment and discharge options necessary to minimize or eliminate the present or future threat to the public health, welfare and environment posed by the organic plume in the groundwater. Similar to the previous evaluations, the no action alternative, GW-1, was not specifically delineated in the FS. For the purposes of the ROD the no action alternative will be considered.

Again, similar to the previous media discussed, the groundwater remedial alternatives retained for detailed analysis have been renumbered for readibility.

New Number	Old number found in RI/FS
GW-1 Shall be considered the No Action Alternative	Not specifically addressed in FS as a discrete remedial alternative.
GW-2	Option 1, On-Site, hot-spot recovery groundwater plume
GW-3	Option 2, Recovery at Site Boundary of groundwater plume
GW-4	Option 3, Recovery downgradient of Site of groundwater plume

It should be noted that FS evaluated a number of unit processes for a treatment system. FS assumes that any combination of unit processes could be applied to each alternative above.

GW-1 No Action Alternative

The no action alternative allows the existing plumes to continue to migrate off-site unabated. The only action required would involve the periodic monitoring of groundwater quality, both to track the downgradient migration of the plume and to detect any significant changes in the status of the plumes which might require additional actions to be taken. Under this alternative the plumes would continue to impact groundwater quality, not only immediately downgradient of the Site, but by ultimately reaching Wells G and H aquifer. As stated earlier, Wells G and H once served as a municipal water supply prior to detection of contamination.

According to costs developed from Appendix I and summarized in Table 52, the quarterly monitoring costs would be $90,000 per year with a present worth costs (assuming a 10% discount rate and a 30 year monitoring period) of approximately $850,000. There are no operation and maintenance costs associated with this alternative except for any monitoring system installed as part of the overall Site remediation.

Discussion of engineering implementation, reliability and constructability is inappropriate, as this is a no action alternative.

The no action alternative does not effectively prevent, mitigate, or minimize threats to, and provide adequate protection of public health and welfare and the environment. Under this alternative, contaminants would continue to be released to the off-site environment permitting an adverse impact to the downgradient groundwater quality. In addition, the alternative would not comply with applicable or relevant and appropriate Federal public health and environmental requirements. The use of the groundwater protection standards under RCRA Part 264 Subpart F, while not applicable would be relevant and appropriate. These standards require that groundwater leaving a Site must meet either background levels, alternate concentration limits (ACLs) or Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act (SDWA). The FS concluded that under this alternative, levels of benzene found at Well G would range between 5 to 10 ppb, above the MCL of 5ppb and well above the RMCL of zero.

In addition to the requirements under RCRA, the Agency's groundwater Protection Strategy (GWPS) would require clean up to similar levels. (The reader is referred to the Consistency with Other Environmental Requirements section for more detail.)

This alternative does not reuse, recycle, minimize of destroy the contaminants, nor does it employ the use of advanced or innovative technologies.

Implementation of this alternative would not pose any adverse environmental impacts.

GW-2 Groundwater interception/recovery of on-site "hot spot" areas.

This alternative involves the selective placement of groundwater recovery wells in the vicinity of the highest detected concentration of benzene. With proper well placement the FS calculated that approximately 80% of the benzene detected would be extracted from the groundwater over a three month period. In addition to the benzene a substantial portion of the toluene would also be captured. The exact number and location of the wells would be determined as part of the Remedial Design (RD) process. The prime criteria to be resolved in the RD is maximizing the contaminant capture while minimizing the length of pumping required. The captured groundwater would be treated to eliminate potential obnoxious odors. Treatment would consist of the addition of ferric chloride and hydrogen peroxide as strong oxidizing agents to quickly break down odor causing sulfur compounds. This treatment would be followed by the use of two counter flow air stripping towers. The use of this type of treatment is particularly effective (99± % removal) for the compounds identified in the groundwater. The effluent of the treatment system would be discharged upgradient of the plumes via a subsurface leachfield. The costs associated with this alternative are summarized in Table 22.

The implementation of this alternative uses conventional engineering technologies and is simple and straightforward to implement. The application of groundwater recovery wells, odor abatement and air stripping for volatile organic compounds (VOCs) are all well established and proven techniques. While subsurface discharge is a proven technology, its success is dependent of a number of factors. Typically the primary problem with subsurface discharge is the clogging at the reinjection point from a stimulated bacterial growth. In the case of Industri-plex, bacterial growth is of real concern due to the presence of a high BOD detected in the on-site groundwater. In addition the presence of a high groundwater table may cause ponding of the leaching trench at the anticipated discharge rates. On the positive side, discharge to the aquifer upgradient of the plume will increase the hydraulic gradient and thereby decrease the required pumping times. By discharging upgradient a higher degree of protection from treatment process upsets would be provided as the effluent would be recycled through the system. The overall effectiveness of this alternative would not be materially affected if the surface discharge portion of the alternative was eliminated. Discharge to surface water would be substituted.

This alternative will effectively prevent, mitigate, or minimize threats to, and provide adequate protection of the public health and welfare. It is marginally protective of the environment. Currently the aquifer underlying the Site is unused as a potable water source and only used by several industries as non-contact cooling water. As a result, at present there is no impact to the public health and welfare. While groundwater analysis indicates that the plumes have migrated off-site impacting the environment, surface water quality sampling has failed to detect any impact resulting from shallow groundwater discharging to nearby streams or Hall's Brook Storage Area. The relatively low capital costs, associated lower O&M costs and relatively short length to complete (estimated at 6 months) make this alternative attractive. The alternative, however, does not meet the applicable or relevant and appropriate Federal public health and environmental requirements for the Site. While this alternative would effectively remove approximately 80% of the contaminants from the groundwater, the remaining 20% would be allowed to migrate off-site. As previously noted in alternative GW-1, off-Site migration of contaminants would not comply with RCRA nor meet the intent of the groundwater Protection Strategy.

The alternative uses treatment of groundwater as a technique to minimize present and future adverse impacts on the groundwater underlying the Site.

Implementation of GW-2 does not pose any significant adverse environmental impacts. However there are several issues which need to resolved as part of the RD. These include, accurate definition of the "hot spot" area so that the type, number and location of recovery wells can be determined, sizing of the treatment system and further investigation as to the feasibility of the use of a subsurface discharge.

GW-3 Groundwater interception/recovery at Site boundary, treatment with surface water discharge

The implementation of GW-3 is similiar to that of GW-2 except for the location of the interception system. Alternative GW-3 would intercept the groundwater at the southern boundary of the Site, thereby preventing any further off-site impact. The RI calculated that placement of five interceptor recovery wells with a total pumping rate of 110 gpm would remove approximately 95% of the benzene within a ten year operating period.

Once collected the recovered groundwater would require treatment. The sampling results from the monitoring wells located along the southern edge of the Site contained high values (300 ppm) of biochemical oxygen demand (BOD). The study concluded that the probable source of the high BOD was the organic materials leaching from the buried hide deposits. The FS determined that, in addition to odor control and VOC removal, BOD treatment would be required in order to minimize clogging of the air stripping towers and to meet NPDES requirements. The FS concluded that use of a Rotating Biological Contactor (RBC) unit would provide effective reduction in BOD while minimizing O&M costs and susceptability to shock loadings. The remainder of the treatment process is similar to that of GW-2. Discharge of the treated effluent will be to the local surface water. Costs and specifications for GW-3 can be located in Tables 23 and 24.

The implementation and reliability of GW-3 is similar to that of GW-2 and does not present any significant implementation problems. Concerns similar to those noted in GW-2, such as the design of the recovery well system will be resolved as part of the Remedial Design.

Similar to alternative GW-2 this alternative was found to meet the remedial objectives established for the Site and like GW-2 this alternative does not meet all applicable or relevant and appropriate Federal public health and environmental requirements. The FS calculated that using this alternative would reduce the concentration of benzene at Well G below the MCL of 5 ppb. However RCRA and the GWPS require that the MCL criteria be applied to the aquifer immediately downgradient of the Site as a potential receptor of concern, not an actual receptor, Wells G and H. As a result, this alternative would not meet the relevant and appropriate requirements.

The FS determined that the effluent from the treatment system is capable of meeting NPDES standards and Water Quality Criteria and therefore would not degrade the local surface water. (see Consistency with Other Environmental Requirements section).

Similar to the previous alternative, this alternative uses treatment of groundwater as an effective technology to minimize present and future adverse impacts to the public health, welfare and environment resulting from contaminated groundwater.

Implementation of GW-2 does not pose any significant adverse environmental impacts.

GW-4 Groundwater Interception/recovery at the leading edge of the plume, treatment and surface water discharge.

Alternative GW-4 uses the same basic framework as the previous alternatives. The primary difference is in the placement of the interceptor/recovery well system and the degree of treatment required in order to meet discharge requirements and effectively treat the wastes. In alternative GW-4 the interceptor/recovery well system is placed at the leading edge of the plume so as to capture the contaminants in their entirety. As a result, virtually all the contaminated groundwater is captured and pumped to the surface for treatment. Based on results from the monitoring wells, the FS concluded that metals removal for zinc, in addition to odor and VOC control, was necessary to meet water quality standards prior to surface water discharge. The FS determined that the Sulfex process for zinc removal was the most suitable treatment system for reducing the concentration of zinc to meet the standard. The metal removal process will be placed after odor control and prior to BOD removal.

The remaining treatment system is the same as described in GW-3 except in size. With the increase in recovery system size (a result of more groundwater to treat) and the addition of the Sulfex process, the disposal of waste sludges generated by the treatment process becomes a concern, under the GW-4 alternative.

the ease of implementation and reliability is similar to that of the previous groundwater alternatives.

This alternative is protective of the public health and welfare and the environment. It meets or exceeds the remedial objectives established for the Site. Because the alternative is designed to capture the entire plume it will effectively prevent, mitigate and eliminate any present or future threat to the public health, welfare and environment. Of the groundwater alternatives evaluated, this alternative, GW-4, meets all applicable or relevant and appropriate Federal public health and environmental requirements.

The use of GW-4 eliminates any potential impacts to the aquifer by using containment and disposal techniques. These techniques are acceptable and proven technologies for removing and treating contaminants from the groundwater. The alternative does not recycle,reuse or destroy the wastes, rather it eliminates the adverse impacts by stripping the VOCs from the groundwater and utilizing the assimilative capacity of the ambient atomsphere to prevent future environmental impacts. As a result, the benzene plume will ultimately be removed from potentially impacting the aquifer directly downgradient of the Site as well as the Wells G and H aquifer. The length of time required to completely remove all the contaminants of concern was not estimated in the FS. However the FS did estimate that it would take approximately ten years to complete one flush cycle in the contaminated portion of the aquifer. Data on transmissivity, storage coefficient and aquifer yield gathered as part of the RD will enable a better prediction as to length of time required to clean the aquifer.

This alternative, similar to GW-3, has several potentially adverse impacts. While the remedy effectively controls or eliminates the impacts to the aquifer resulting from the Site, neither alternative adequately addresses ongoing and potential problems around the Site. The increased capital and operation and maintenance costs, increased period of performance required to meet objectives and the potential of the need to handle a hazardous waste sludge make this alternative of questionable benefit as an remedy. In addition to the above noted concerns, the RI calculated that there was likely to be a localized lowering of the groundwater table as the result of the substantial pumping required for the interception/recovery network to be effective. This decrease in the localized water table may partially dewater portions of wetlands located south of the Site.

V. COMMUNITY RELATIONS

The Industri-plex 128 site was one of the first sites identified in Region I. In addition the Site was the highest scoring site of GW-2 and does not present any significant implementation problems. Concerns similar to those noted in GW-2, such as the design of the recovery well system will be resolved as part of the Remedial Design.

Similar to alternative GW-2 this alternative was found to meet the remedial objectives established for the Site and like GW-2 this alternative does not meet all applicable or relevant and appropriate Federal public health and environmental requirements. The FS calculated that using this alternative would reduce the concentration of benzene at Well G below the MCL of 5 ppb. However RCRA and the GWPS require that the MCL criteria be applied to the aquifer immediately downgradient of the Site as a potential receptor of concern, not an actual receptor, Wells G and H. As a result, this alternative would not meet the relevant and appropriate requirements.

The FS determined that the effluent from the treatment system is capable of meeting NPDES standards and Water Quality Criteria and therefore would not degrade the local surface water. (see Consistency with Other Environmental Requirements section).

Similar to the previous alternative, this alternative uses treatment of groundwater as an effective technology to minimize present and future adverse impacts to the public health, welfare and environment resulting from contaminated groundwater.

Implementation of GW-2 does not pose any significant adverse environmental impacts.

GW-4 Groundwater Interception/recovery at the leading edge of the plume, treatment and surface water discharge.

Alternative GW-4 uses the same basic framework as the previous alternatives. The primary difference is in the placement of the interceptor/recovery well system and the degree of treatment required in order to meet discharge requirements and effectively treat the wastes. In alternative GW-4 the interceptor/recovery well system is placed at the leading edge of the plume so as to capture the contaminants in their entirety. As a result, virtually all the contaminated groundwater is captured and pumped to the surface for treatment. Based on results from the monitoring wells, the FS concluded that metals removal for zinc, in addition to odor and VOC control, was necessary to meet water quality standards prior to surface water discharge. The FS determined that the Sulfex process for zinc removal was the most suitable treatment system for reducing the concentration of zinc to meet the standard. The metal removal process will be placed after odor control and prior to BOD removal.

The remaining treatment system is the same as described in GW-3 except in size. With the increase in recovery system size (a result of more groundwater to treat) and the addition of the Sulfex process, the disposal of waste sludges generated by the treatment process becomes a concern, under the GW-4 alternative.

within the Region on the NPL while another site (Wells G&H) associated with childhood leukemia was located just south of this Site. As a result public and media attention as well as community involvement has always been very high.

In April 1980, the Massachusetts Secretary of Environmental Affairs formed a Citizens Advisory Committee (CAC) under a provision in the Massachusetts Environmental Policy Act (MEPA). The committee, consisting of representatives of the city, local residents, ad hoc environmental groups, the Chamber of Commerce and surrounding towns, has met on a regular basis to be briefed by regulatory personnel, comment and have input on draft proposals or reports. By all standards the involvement of the CAC has been an outstanding success in allowing the impacted community to be involved in the decision making process while allowing the regulatory agencies to have a better understanding of the needs and feelings of the community.

In addition to the CAC, the Agency has held numerous public meetings. Upon completion of the RI/FS the Agency held a formal Public Hearing on the RI/FS in July 1985. Comments received with Agency responses are appended in the Responsiveness Summary.

VI. CONSISTENCY WITH OTHER ENVIRONMENTAL REQUIREMENTS

The CERCLA Compliance with Other Environmental Statutes Policy requires that subject to limited exceptions, Superfund remedies shall attain or exceed applicable or relevant and appropriate Federal environmental and public health requirements in CERCLA response actions. This policy is embodied in 40 CFR §300.68(h)(iv) which requires as part of the detailed analysis of alternatives an evaluation of the extent to which the alternatives attain or exceed the applicable or relevant and appropriate requirements (ARARs). Where the FS was initiated but the remedy not selected as of the October 2, 1985 effective date of the policy, the ARARs analysis was to be incorporated into the FS and Record of Decision (ROD) as practicable.

A review of applicable or relevant and appropriate Federal public health and environmental requirements was conducted as part of the FS. This evaluation was deficient with respect to §300.68(i) of the NCP, dated November 20, 1985. As a result, the Agency undertook an independent review of the requirements to determine their possible implementation at the Site. Summarized below are the findings for each environmental media requiring remedial action.

As applied to this case there are three types of ARARs: cleanup levels of hazardous substances, cleanup technology requirements and requirements triggered by the implementation of cleanup activities.

Soils

With respect to soils contamination at the Site, there are not ARARs establishing cleanup levels.

With respect to cleanup technologies, RCRA requirements were reviewed as potential ARARs. As the wastes were disposed of prior to the effective implementation date of the RCRA waste management regulations, RCRA was determined not to be applicable. If the wastes on-site were either a listed waste or met the characteristic waste tests, then all the waste management requirements of RCRA would be relevant and appropriate. The metal wastes found on-site are neither listed nor meet the characteristic tests. However certain technological engineering concepts were viewed to be relevant and appropriate. RCRA closure requirements call for impermeable covers for landfills. The rationale for this technology is that an impermeable cover eliminates the potential for direct contact and mitigates adverse groundwater impacts resulting from percolation of precipitation through the wastes. Results from the RI indicate that percolation of precipitation through the metal wastes at this Site is not presenting a significant impact to off-site groundwater. As a result the requirement of impermeability is not relevant and appropriate to capping technology at this Site. However, the use of a cap is appropriate to eliminate the potential for direct contact.

For alternatives that cap wastes in-situ or consolidate wastes elsewhere on-site, sections of Part 264 Subpart G involving closure and post closure care are also relevant and appropriate for use at this Site. Part 264 Subpart G requires a written closure plan for the Site, establishes a period of post-closure care (30 years) and use of the property and outlines maintenance and monitoring requirements. In addition, this Subpart outlines a procedure for documenting the location of the wastes to ensure against accidental disturbance. The primary purpose of this subpart is to ensure that the effectiveness of the remedial action is maintained and that, in the event of a problem it is quickly detected and resolved.

Implementation of several of the alternatives considered in the FS would trigger other ARARs. For instance; Alternatives that require discharge of fill material to a wetlands trigger CWA §404(b)(1) guidelines. In addition, Federal actions involving wetlands are subject to the conditions of Executive Order 11990. The essence of these two requirements is to prohibit the filling or impacting of a wetlands unless no other practicable alternative exists and to mandate mitigative measures where actions in wetlands are taken.

The implementation of the two requirements, noted above, involve areas of the Site where waste deposits are in direct contact with surface waters and wetlands. Specifically, these areas are the pond located between the East and West Hide Pile along with the stream discharging from the pond, the drainage ditch paralleling New Boston Street and the drainage swale next to the Chromium Lagoon area, draining into the Hall's Brook Storage Area. In each area, waste deposits are in direct contact with surface waters and wetlands. This situation exists as the result of either the materials being placed into the wetlands during initial disposal or a drainage ditch being excavated through a waste deposit during Site development. In any event, the presence of these wastes in contact with the wetlands permits the continued release of contaminants to the environment. In order to eliminate this on-going release or threat of release, the waste material must be physically separated from direct contact with the surface waters and wetlands. Basically there are two methods for accomplishing this goal. The first involves excavating the material from the surface waters and wetlands and then placing the excavated materials in an uplands area. Excavation and removal of this material to an uplands would comply with §404(b)(1) of the CWA, as it only regulates the discharge of dredge or fill material into a wetlands, not the removal of the material. The second method involves the placement of either clean fill material or piping into the surface waters or wetlands to physically separate the wastes from the media. If the former alternative was available and practicable for use in a particular application, then this latter alternative would not comply with §404(b)(1) as it involves the placement of fill material into a wetlands. Neither alternative would comply with the intent of Executive Order 11990. This is because the Executive Order 11990 is much broader in scope than §404(b)(1). The Executive Order addresses any action (excavation or filling) which might adversely impact the wetlands.

The no action alternative, S-1, is the only remedial action which would not adversely disturb and impact the wetlands, thereby complying with §404(b)(1) and the Executive Order 11990. Under this alternative, the waste materials would be allowed to remain in, and adjacent to, the surface waters and wetlands. This would allow the continued release or threat of release to the environment. In addition, the alternative would leave exposed levels of toxic metals in excess of action levels determined to be protective of the public health and welfare. Due to the nature of the Site, there exists a real potential for individuals to come in direct contact with these exposed wastes. As a result of the continued release or threat of release to the public health and welfare and the environment the Agency rejected the no action alternative as not being protective and not meeting the established goals for the Site. As a result of this determination, the Agency has determined that there is no practicable alternative that exists which would comply with the Executive Order 11990 and not impact the wetlands. The Agency believes, however, that there remain alternatives that can be structured in such a manner as to minimize potential harm to the wetlands using mitigative measures and to compensate for any impact as required under §404(b)(1). For metal wastes, the deposits can be dredged from the wetlands, thereby complying with §404(b)(1) requirements; however, for the West Hide Pile this dredge alternative is not practicable because of the potential for release of obnoxious odors. As a result, in order to stabilize the side slopes of the West Hide Pile, some limited excavation and filling of the wetlands will be required. The exact quantities are currently not known, however the projected areas of concern are detailed in the appropriate section and compliance with the technical requirements of §404(b)(1) will be incorporated into the Remedial Design process.

The National Ambient Air Quality Standards (NAAQS) of the Clean Air Act (CWA) may be applicable to alternatives involving the removal or placement of materials, either clean or waste deposits. The Standards, listed below, are mandatory goals for non-attainment areas to protect both the public health (primary standards) and welfare (secondary standards). The Total Suspended Particulates and Lead standards would be applicable during the excavation of waste material or the placement of cover material at the Site.

Applicable National Air Quality Standards

Pollutant	Averaging Time	Primary Standard	Secondary Standard
Total Suspended Particulates	Annual	75 ug/m^3	----
	24 Hours	260 ug/m^3	150 ug/m^3
Lead	Quarterly	1.5 ug/m^3	same

During test pit excavation the RI collected and analyzed ambient air samples for these parameters to determine if a violation of the NAAQS standards existed. Results indicate that all remedial alternatives would be well below the standards.

In addition to the NAAQS requirements, the Unit Risk values developed by EPA's Carcinogenic Assessment Group were considered for use at the Site as a relevant and appropriate guideline under the CAA. Although referred to, at several points within the document, as an ARAR, the Unit Risk values fall within the category of standards that are "to be considered by the Agency". The definition of Unit Risk is the increased lifetime cancer risk occurring in a hypothetical population in which all individuals are exposed continously from birth throughout their lifetimes to a concentration of one ug/m^3 of the agent in the air they breathe. A lifetime is considered to be 70 years. These are considered guidelines and not requirements. Application at this Site could potentially apply during excavation and removal.

Chemical	Unit Risk
Benzene	8.0×10^{-6}
Chromium	1.2×10^{-2}

Chemical	Unit Risk
Nickel	3.0×10^{-4}
Toluene	NA

Results from the RI indicate that air emissions from implementation of any of the soils alternatives would be well below the established guidelines for the Unit Risk.

In addition to the relevant and appropriate requirements for the protection of the wetlands, National Ambient Water Quality Criteria may be relevant and appropriate for alternatives which involve the release or potential for release of contaminants to the surface water. Under the Clean Water Act (CWA) the Massachusetts Water Quality Standards are federally enforceable standards and would be applicable. In the absence of a numeric standard for a given substance in the State Water Quality Standards, the criterion is, under CERCLA policy, deemed relevant and therefore to be considered in the selection of the remedy. Listed below are the National Ambient Water Quality Criteria.

Compound	Concentration (ppm)[1]	Chronic 4 day avg/3 yr (ug/l)	Acute 1 hr avg/3 yr (ug/l)
Arsenic	<10 min	---	---
	288 avg	190	360
	30,800 max	---	---
Lead	ND min	---	---
	1,263 avg	1.3	34
	54,400 max	---	---
Chromium	<10 min	---	---
	718 avg	120 (11)[2]	980 (16)[2]
	80,600 max	---	---
Zinc	---	47	159
Copper	---	6.5	9.2
Mercury	---	0.012	2.4
Benzene	---	---	5,300
Toluene	---	---	17,500
di(ethyhexyl) phthalate	---	3	940
Phenol	---	2,560	10,200

1. Criteria variable; toxicity is dependent on hardness
2. Values within ( ) are for hexavalent chromium, other values are for trivalent.

These criteria are used to ensure that the surrounding water quality is not adversely impacted during or after the implementation of the remedial action. Efforts to minimize any potential threat of release or impact to the surrounding water quality would be incorporated as part of the Remedial Design process. For example, use of sedimentation basins and erosion control fabric are two possible techniques to prevent a surface water quality impact from occurring.

As stated previously, with the exception of the no action alternative, S-1, no alternatives will meet all the applicable or relevant and appropriate Federal public health and environmental requirements. Alternatives S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-11, S-12 and S-13 would closely approach the level of protection provided by the applicable or relevant and appropriate Federal public health and environmental requirements.

Alternative S-11, the recommended remedial action, would comply with the applicable or relevant and appropriate Federal public health and environmental requirements. Because no practicable alternative exists which does not impact the wetlands, compliance with the mitigative measures required under §404(b)(1) will be required during the implementation of this alternative.

Unlike some alternatives which include consolidation or removal as part of the remediation, Alternative S-11 seeks to meet the wetland requirements by leaving the majority of the waste deposits in-situ. This would minimize the effects of sedimentation, erosion and the need to construct access and egress roads in and around the wetlands. Under the consolidation/removal alternatives the majority of the wetlands and surface waters would either be destroyed or altered during the implementation of the alternative. Under alternative S-11 waste deposits from the area south of the East and West Hide Piles which were in direct contact with surface water and/or wetlands would carefully be excavated, using a dragline. Sufficient quantity of material would be removed in order to allow limited placement of clean fill material to form a dike or berm between the surface waters or wetlands and the remaining waste deposits. The amount of waste material excavated would be in excess of the amount of clean fill material placed yielding a net positive increase in flood storage capacity and increasing the area for the affected wetlands to reestablish itself. The excavated material would be located in an upland area, eliminating any future impacts. In addition, the Agency shall also act to restore and preserve the natural and beneficial values of the wetlands.

Air

With respect to air contamination there are three ARARs establishing cleanup levels at the Site. First, as noted under the soils ARARs section, they are the NAAQS requirements. These standards would be applicable for use at this Site to ensure that the ambient air quality is not degraded as a result of air emissions from an air treatment system. Listed below are the appropriate standards.

Applicable National Air Quality Standards

Pollutant	Averaging Time	Primary Standard	Secondary Standard
Sulfur Dioxide	Annual	80 ug/m^3	----
	24 Hours	365 ug/m^3	----
	3 Hours	----	1300 ug/m^3
Total Suspended Particulates	Annual	75 ug/m^3	----
	24 Hours	260 ug/m^3	150 ug/m^3
Carbon Monoxide	8 Hours	10 ug/m^3	same
	1 Hour	40 ug/m^3	same
Ozone	1 Hour	235 ug/m^3	same
Nitrogen Dioxide	Annual	100 ug/m^3	same
Lead	Quarterly	1.5 ug/m^3	same

The implementation of an ambient monitoring plan will be required to determine that the ambient air quality of the surrounding area is not degraded as a result of the implementation of an air alternative.

Second, because the potential exists that some carcinogenic volatile organic compounds may be emitted in low levels from the East Hide Pile the use of the Unit Risk values is relevant and appropriate for the Site. These values are summarized below.

Chemical	Unit Risk
Benzene	8.0×10^{-6}
Chromium	1.2×10^{-2}
Dioxin	3.3×10^{-5}
Nickel	3.0×10^{-4}
Phenol	NA
Toluene	NA

The third ARAR to be considered as relevant and appropriate is the applicable state requirement relative to the control of nuisance odors. Similar to the use of Unit Risk values in the previous section, use of State standards also falls into the "to be considered" category and technically is not an ARAR. The Agency has decided, in accordance with parts 300.68(i)(4) and (i)(5)(ii) of the NCP, that the Commonwealth's "Regulations for the Control of Air Pollution" (310 CMR 7.00) to the mandates of the CAA and Massachusetts General Laws Chapter III, Parts 142 B and D, are relevant and appropriate to the East Hide Pile. There are no numeric standards for the control of odor, only the requirement that nuisance odors are not permitted to exist, and that every reasonable appropriate control technology be used to prevent the release of nuisance odors. While the Agency can regulate these odors based on their adverse impacts on the public welfare as defined in both CERCLA and CAA, the Agency considers 310 CMR 7.00, and specifically 310 CMR 7.09 relevant and appropriate since it formed the legal basis for the protracted litigation initiated by the DEQE and the Town of Reading against the Site's developer. This litigation resulted in an order issued by the presiding judge prohibiting any excavation at Industri-plex that could result in the release of odors. The judge prohibited excavation rather than requiring odor control measures during excavation because after experiments and field tests of various methods, none were found to be effective in preventing or minimizing the release of intense odors during excavation. The odor problem caused by the Site is so long standing and the community opposition to it is so strong that in addition to harming the public welfare, the intense, obnoxious odors that would necessarily attend excavating the pile would in all likelihood provoke renewal of the previously mentioned lawsuits.

It should also be noted that the Agency, the DEQE and Stauffer Chemical Company have agreed in their administrative consent order to treat odors as hazardous substances pursuant directly to the requirements of CERCLA.

With respect to ARARs triggered as a result of the implementation of a cleanup activity, §404(b)(1) and the Executive Order 11990 on Wetlands would be applicable. This is because a significant portion of the East Hide Pile is physically located in a wetlands. The implementation and restrictions for the air alternatives would be similar to requirements under the soils ARARs. As previously noted, these wetlands requirements prohibit impacting a wetlands unless no other practicable alternative exists.

The East Hide Pile is unstable and continues to slough material into the wetland and/or surface water and because it is essentially barren of vegetation allowing toxic material and material high in biological oxygen demand (BOD) to readily erode into the wetland and/or surface water every time it rains or snows. Any action taken to abate the continued sloughing of the pile into the wetlands would, by its very nature, impact the wetlands. For reasons previously stated in the soils section, there exists no practicable alternative which would not impact the wetlands. As noted above, any disturbance of the hide material releases a strong obnoxious odor. As a result, the technique of utilizing a dragline to excavate the wastes from the wetlands is not appropriate. Because the side slopes of the pile are steep, thereby allowing continual sloughing, remedial actions to stablize the slopes are required. This will necessitate impinging on the wetlands. The FS illustrated remedial alternatives which involved the total draining and filling of the wetlands in order to eliminate the potential for direct contact and to lower the local groundwater table, thereby assisting in dewatering the pile. The Agency disagrees with the conclusion that it is necessary to dewater the wetlands in order to reach the remedial objectives established for the Site. The Agency believes that techniques involving sheet piling and more aggressive slope stablization methods can significantly minimize the impacts to the wetlands. The recommended remedial action for the air alternative uses the modified slope stabilization techniques to address this issue.

Groundwater

The groundwater protection requirements under 40 CFR Part 264 Subpart F would be relevant and appropriate to the groundwater problems associated with this Site. Subpart F requires that hazardous constituents in groundwater leaving the Site must not exceed the background level of that constituent in the groundwater, a Maximum Contaminant Level (MCL) or an Alternate Concentration Limit (ACL), site specific levels that are determined to be protective of the public health and environment.

Forty CFR Part 141 and Part 142 of the National Primary Drinking Water Regulations are regulations which implement the Safe Drinking Water Act (SDWA). The SDWA has promulgated interim Maximum Contaminant Levels (MCLs) for a number of metals and also has proposed MCLs and/or Recommended Maximum Contaminant Levels (RMCLs) for some metals and synthetic organic chemicals. Listed below are the RMCLs and MCLs for the compounds of concern:

Compound	RMCL(mg/l)	MCL(mg/l)
Arsenic	0.05 proposed	0.05 interim prom
Chromium	0.12 proposed	0.05 " "
Lead	0.02 proposed	0.05 " "
Benzene	Zero promulgated	0.005 proposed
Toluene	2.0 proposed	---

MCL's are standards for public water systems based on health, technological and economic feasibility. RMCL's are suggested levels for drinking water based entirely on health considerations. The use of MCLs and RMCLs as target groundwater cleanup levels is consistent with the RCRA requirements. Results from the groundwater sampling indicate groundwater leaving the Site is in excess of the established MCLs and RMCLs.

In addition to the applicable regulation, the Agency's Ground Water Protection Strategy (GWPS) establishes guidelines for protection of the nation's groundwater.

The strategy classifies all groundwater into three basic categories. The groundwater underlying the Site would be classified as a Class 2B aquifer. The Class 2B is an aquifer which is a Potential Source of Drinking Water and Water Having Other Beneficial Uses. As noted previously, the aquifer underlying the Site flows southerly feeding the portion of the Aberjona River aquifer which supplied Wells G and H, two of the City of Woburn's municipal drinking water wells. As noted above, the GWPS establishes guidelines for groundwater protection. For a Class 2B aquifer, cleanup of contamination will usually be to background levels or drinking water standards, but alternative procedures may be applied for potential sources of drinking water or water used for agricultural or industrial purposes. EPA recognizes that in some cases alternatives to groundwater cleanup and restoration may be appropriate. In addition the GWPS indicates that for groundwaters not used as current sources of drinking water, the Agency will also consider regulatory changes to allow variances in cleanup that take into account such factors as the probability of eventual use as drinking water and the availability of cost-effective methods to ensure acceptable water quality at the point of use. Other factors such as yield, accessibility, and alternative sources will also be considered.

Once the groundwater has been successfully extracted from the aquifer it would receive treatment to remove the contaminants prior to discharge. The effluent from the treatment system would need to comply with all applicable or relevant and appropriate Federal public health and environmental requirements. Two regulations are applicable to the treatment and discharge of the groundwater to a surface water. Section 303 of the Clean Water Act (CWA) requires that any discharge to a surface water be subjected to the federally enforceable Massachusetts Water Quality Standards. In the absence of a numeric standard for a given substance in the Water Quality Standards, the National Ambient Water Quality Criteria are applied. In addition §402(a)(1) - 402(a)(3) of CWA which deals with the National Pollutant Discharge Elimination System (NPDES) would be relevant and appropriate for the effluent of the treatment system. The NPDES program establishes limits on a permit by permit basis, using secondary treatment standards as a starting point. The permit program not only requires that mimimal treatment standards be met but that water quality standards (noted above) be attained as well.

As noted in the air section, the emission from the air stripping tower would be subject to the Clean Air Act, both in terms of the NAAQS standards and the Unit Risk guidelines.

Only alternative GW-4 would meet the applicable or relevant and appropriate Federal public health and environmental requirements.

By capturing the leading edge of the plume this alternative would ultimately reduce the levels in the groundwater to Drinking Water Standards. The FS estimates that this alternative would require in excess of ten years to accomplish this goal. Alternatives GW-3, GW-2 and GW-1 would not comply with the applicable requirements as each would allow levels to remain in the groundwater in excess of the RCRA requirements. The treatment systems outlined in GW-2, GW-3 and GW-4 are all capable of meeting NPDES and water quality standards. However, pilot studies during the Remedial Design would be necessary to ensure the effectiveness of the treatment system to remove metals to the low levels needed.

VII. RECOMMENDED ALTERNATIVES

Consistent with 40 C.F.R. §300.68(i), the following alternatives have been determined to be the cost-effective remedial alternatives that effectively mitigate and minimize threats to and provide adequate protection of public health and welfare and the environment.

This section summarizes the recommended remedial actions to be taken to eliminate the hazardous waste impacts to the contaminated soils, the East Hide Pile and the contaminated groundwater.

RECOMMENDED REMEDIAL ACTION FOR CONTAMINATED SOILS

Alternative S-11 was selected as the recommended remedial alternative under §300.68(i) of the NCP. The alternative will eliminate the potential for direct contact with contaminated soils at levels above 300 ppm arsenic, 600 ppm lead, and 1000 ppm chromium. These levels were established in the Endangerment Assessment (EA) as being protective of the public health and welfare and the environment. Specifically, the alternative will cap contaminated soils with clean materials to a depth sufficient to minimize the effects of the freeze-thaw cycle and the potential for exposure resulting from erosion. Based on knowledge and experience gained in other CERCLA responses, most notably the capping of asbestos landfills, the Agency has determined that thirty inches of clean cover material over an exposed deposit is an appropriate method for eliminating the potential for direct contact and future exposure. As a result the recommended remedial action will cover the exposed deposits with thirty inches of clean fill material. In areas where the waste is already partially protected by clean fill material, only enough additional cover material will be placed to provide for the minimum of thirty inches of protection. Areas containing buildings, roadways and parking lots would not receive cover material, instead allowing the structures themselves to act as the protective cap. In addition, there may be small areas on-site where it is more advantageous to remove waste material than to attempt to establish protection using cover material. These areas are likely to be around existing structures, i.e. the grassed area between a building and a parking lot. Clearly placement of an additional thirty inches of cover material against an existing structure may be inappropriate and could result in significant problems. In these instances the waste material may be excavated from the area to an appropriate depth and the excavation backfilled with clean material. The excavated material will be consolidated elsewhere on-site with wastes having the same characteristics as the excavated material. Another alternative would be the placement of a protective layer such as asphalt to cap the deposit. In any event, these areas will be further identified and specific actions to resolve the issue will be developed during the Remedial Design process.

For areas where waste deposits are in direct contact with wetlands or surface waters, one of two alternatives will be used to eliminate the adverse impacts resulting from the potential for direct contact. First, for areas involving wetlands or the pond where there are no hide materials,the wastes will be excavated using a dragline. Use of a dragline will minimize the adverse impacts to the wetlands while allowing the wastes to be physically removed from the water. For areas containing hide materials which have the potential for odor release, the deposits will be covered in-situ, minimizing to the extent practical the impact on the wetlands. For manmade drainage swales, culverting may also be an acceptable alternative to the dragline.

Irrespective of the depth below grade, location or the presence of an existing structure, any areas containing wastes above the action levels will receive institutional controls. These controls are designed to ensure the long term effectiveness of the remedial action by preventing the unauthorized or inadvertent disturbance of the waste deposits. The nature and scope of the institutional controls will be similar to those required under Part 264 Subpart G of RCRA. Specifically, §264.117 Post Closure care and use of Property, §264.119 Notice to local land Authority and §264.120 Notice in deed to Property. In addition to these requirements, the Agency is currently investigating the possible modification of the City of Woburn's zoning regulations to further assist in the control and future use of the affected properties. The Agency recognizes that the remedial action may need to be disturbed or modified at some future point, given the amount of Site development currently existing. A plan outlining the conditions under which the remedial action could be disturbed will be developed and approved as part of the Remedial Design process.

The primary advantage of this alternative over previous alternatives, specifically S-4 is the lower capital and O&M costs resulting from the decreased area requiring remedial action. In S-4 the alternative encompassed any deposit above 100 ppm irrespective of depth below grade. In alternative S-11 clean uncontaminated fill material will be placed in sufficent quantity to establish a thirty inch protective layer. This effectively reduces the area from seventy acres under S-4 to the wastes from the wetlands is not appropriate. Because the side slopes of the pile are steep, thereby allowing continual sloughing, remedial actions to stablize the slopes are required. This will necessitate impinging on the wetlands. The FS illustrated remedial alternatives which involved the total draining and filling of the wetlands in order to eliminate the potential for direct contact and to lower the local groundwater table, thereby assisting in dewatering the pile. The Agency disagrees with the conclusion that it is necessary to dewater the wetlands in order to reach the remedial objectives established for the Site. The Agency believes that techniques involving sheet piling and more aggressive slope stablization methods can significantly minimize the impacts to the wetlands. The recommended remedial action for the air alternative uses the modified slope stabilization techniques to address this issue.

Groundwater

The groundwater protection requirements under 40 CFR Part 264 Subpart F would be relevant and appropriate to the groundwater problems associated with this Site. Subpart F requires that hazardous constituents in groundwater leaving the Site must not exceed the background level of that constituent in the groundwater, a Maximum Contaminant Level (MCL) or an Alternate Concentration Limit (ACL), site specific levels that are determined to be protective of the public health and environment.

Forty CFR Part 141 and Part 142 of the National Primary Drinking Water Regulations are regulations which implement the Safe Drinking Water Act (SDWA). The SDWA has promulgated interim Maximum Contaminant Levels (MCLs) for a number of metals and also has proposed MCLs and/or Recommended Maximum Contaminant Levels (RMCLs) for some metals and synthetic organic chemicals. Listed below are the RMCLs and MCLs for the compounds of concern:

Compound	RMCL(mg/l)	MCL(mg/l)
Arsenic	0.05 proposed	0.05 interim prom
Chromium	0.12 proposed	0.05 " "
Lead	0.02 proposed	0.05 " "
Benzene	Zero promulgated	0.005 proposed
Toluene	2.0 proposed	---

MCL's are standards for public water systems based on health, technological and economic feasibility. RMCL's are suggested levels for drinking water based entirely on health considerations. The use of MCLs and RMCLs as target groundwater cleanup levels is consistent with the RCRA requirements. Results from the groundwater sampling indicate groundwater leaving the Site is in excess of the established MCLs and RMCLs.

In addition to the applicable regulation, the Agency's Ground Water Protection Strategy (GWPS) establishes guidelines for protection of the nation's groundwater.

The strategy classifies all groundwater into three basic categories. The groundwater underlying the Site would be classified as a Class 2B aquifer. The Class 2B is an aquifer which is a Potential Source of Drinking Water and Water Having Other Beneficial Uses. As noted previously, the aquifer underlying the Site flows southerly feeding the portion of the Aberjona River aquifer which supplied Wells G and H, two of the City of Woburn's municipal drinking water wells. As noted above, the GWPS establishes guidelines for groundwater protection. For a Class 2B aquifer, cleanup of contamination will usually be to background levels or drinking water standards, but alternative procedures may be applied for potential sources of drinking water or water used for agricultural or industrial purposes. EPA recognizes that in some cases alternatives to groundwater cleanup and restoration may be appropriate. In addition the GWPS indicates that for groundwaters not used as current sources of drinking water, the Agency will also consider regulatory changes to allow variances in cleanup that take into account such factors as the probability of eventual use as drinking water and the availability of cost-effective methods to ensure acceptable water quality at the point of use. Other factors such as yield, accessibility, and alternative sources will also be considered.

Once the groundwater has been successfully extracted from the aquifer it would receive treatment to remove the contaminants prior to discharge. The effluent from the treatment system would need to comply with all applicable or relevant and appropriate Federal public health and environmental requirements. Two regulations are applicable to the treatment and discharge of the groundwater to a surface water. Section 303 of the Clean Water Act (CWA) requires that any discharge to a surface water be subjected to the federally enforceable Massachusetts Water Quality Standards. In the absence of a numeric standard for a given substance in the Water Quality Standards, the National Ambient Water Quality Criteria are applied. In addition §402(a)(1) - 402(a)(3) of CWA which deals with the National Pollutant Discharge Elimination System (NPDES) would be relevant and appropriate for the effluent of the treatment system. The NPDES program establishes limits on a permit by permit basis, using secondary treatment standards as a starting point. The permit program not only requires that mimimal treatment standards be met but that water quality standards (noted above) be attained as well.

As noted in the air section, the emission from the air stripping tower would be subject to the Clean Air Act, both in terms of the NAAQS standards and the Unit Risk guidelines.

Only alternative GW-4 would meet the applicable or relevant and appropriate Federal public health and environmental requirements.

By capturing the leading edge of the plume this alternative would ultimately reduce the levels in the groundwater to Drinking Water Standards. The FS estimates that this alternative would require in excess of ten years to accomplish this goal. Alternatives GW-3, GW-2 and GW-1 would not comply with the applicable requirements as each would allow levels to remain in the groundwater in excess of the RCRA requirements. The treatment systems outlined in GW-2, GW-3 and GW-4 are all capable of meeting NPDES and water quality standards. However, pilot studies during the Remedial Design would be necessary to ensure the effectiveness of the treatment system to remove metals to the low levels needed.

VII. RECOMMENDED ALTERNATIVES

Consistent with 40 C.F.R. §300.68(i), the following alternatives have been determined to be the cost-effective remedial alternatives that effectively mitigate and minimize threats to and provide adequate protection of public health and welfare and the environment.

This section summarizes the recommended remedial actions to be taken to eliminate the hazardous waste impacts to the contaminated soils, the East Hide Pile and the contaminated groundwater.

RECOMMENDED REMEDIAL ACTION FOR CONTAMINATED SOILS

Alternative S-11 was selected as the recommended remedial alternative under §300.68(i) of the NCP. The alternative will eliminate the potential for direct contact with contaminated soils at levels above 300 ppm arsenic, 600 ppm lead, and 1000 ppm chromium. These levels were established in the Endangerment Assessment (EA) as being protective of the public health and welfare and the environment. Specifically, the alternative will cap contaminated soils with clean materials to a depth sufficient to minimize the effects of the freeze-thaw cycle and the potential for exposure resulting from erosion. Based on knowledge and experience gained in other CERCLA responses, most notably the capping of asbestos landfills, the Agency has determined that thirty inches of clean cover material over an exposed deposit is an appropriate method for eliminating the potential for direct contact and future exposure. As a result the recommended remedial action will cover the exposed deposits with thirty inches of clean fill material. In areas where the waste is already partially protected by clean fill material, only enough additional cover material will be placed to provide for the minimum of thirty inches of protection. Areas containing buildings, roadways and parking lots would not receive cover material, instead allowing the structures themselves to act as the protective cap. In addition, there may be small areas on-site where it is more advantageous to remove waste material than to attempt to establish protection using cover material. These areas are likely to be around existing structures, i.e. the grassed area between a building and a parking lot. Clearly placement of an additional thirty inches of cover material against an existing structure may be inappropriate and could result in significant problems. In these instances the waste material may be excavated from the area to an appropriate depth and the excavation backfilled with clean material. The excavated material will be consolidated elsewhere on-site with wastes having the same characteristics as the excavated material. Another alternative would be the placement of a protective layer such as asphalt to cap the deposit. In any event, these areas will be further identified and specific actions to resolve the issue will be developed during the Remedial Design process.

For areas where waste deposits are in direct contact with wetlands or surface waters, one of two alternatives will be used to eliminate the adverse impacts resulting from the potential for direct contact. First, for areas involving wetlands or the pond where there are no hide materials,the wastes will be excavated using a dragline. Use of a dragline will minimize the adverse impacts to the wetlands while allowing the wastes to be physically removed from the water. For areas containing hide materials which have the potential for odor release, the deposits will be covered in-situ, minimizing to the extent practical the impact on the wetlands. For manmade drainage swales, culverting may also be an acceptable alternative to the dragline.

Irrespective of the depth below grade, location or the presence of an existing structure, any areas containing wastes above the action levels will receive institutional controls. These controls are designed to ensure the long term effectiveness of the remedial action by preventing the unauthorized or inadvertent disturbance of the waste deposits. The nature and scope of the institutional controls will be similar to those required under Part 264 Subpart G of RCRA. Specifically, §264.117 Post Closure care and use of Property, §264.119 Notice to local land Authority and §264.120 Notice in deed to Property. In addition to these requirements, the Agency is currently investigating the possible modification of the City of Woburn's zoning regulations to further assist in the control and future use of the affected properties. The Agency recognizes that the remedial action may need to be disturbed or modified at some future point, given the amount of Site development currently existing. A plan outlining the conditions under which the remedial action could be disturbed will be developed and approved as part of the Remedial Design process.

The primary advantage of this alternative over previous alternatives, specifically S-4 is the lower capital and O&M costs resulting from the decreased area requiring remedial action. In S-4 the alternative encompassed any deposit above 100 ppm irrespective of depth below grade. In alternative S-11 clean uncontaminated fill material will be placed in sufficent quantity to establish a thirty inch protective layer. This effectively reduces the area from seventy acres under S-4 to forty three acres under S-11. The alternative would control the difference in acreage by implementing institutional controls over those areas not receiving cover material. The approach used in S-11 is a sound and logical method for eliminating the potential for direct contact. First, the alternative uses values determined to be protective of the public health, welfare and environment, not an arbitrarily selected number. Secondly, the alternative minimizes unnecessary disruption to surrounding areas by covering only those areas necessary to minimize the effects of the freeze-thaw cycle and erosion. Finally, the use of institutional controls over the entire contaminated area will ensure the long term effectiveness of the remedial action.

This alternative is not without its disadvantages. The primary one involves the dependence on the use of institutional controls not only to ensure the long term effectiveness of the alternative, but as part of the alternative as well. An argument could be raised that the reliance on institutional controls is inappropriate as an effective means to contain the waste deposits on-site. The Agency recognizes that use of institutional controls have some disadvantages but that Site conditions are such that the use of them is the key to implementing an effective environmental solution to the Site. Because Site development occurred after the deposition of the wastes, many of the existing structures are built on top of waste deposits above the action levels. While it is unlikely that these deposits will be exposed to the public health or environment in the near future, at some point in time these deposits could pose a significant threat to the public health and environment as a result of the structure being removed or altered in some fashion. In order to prevent this from arbitrarily occurring one of two things must happen. Either the disturbance of the waste is controlled through institutional controls or the material must be physically removed from its present location and placed where the Agency can be assured it is not inadvertently disturbed. Removal from its present location is not justified, based on results in the EA, therefore in-situ covering and monitoring are the most appropriate remedial action to be taken.

In the event that institutional controls are not obtainable, this alternative would have to be reconsidered, leaving alternatives S-7, S-8, S-9 and S-13 as the more viable alternatives. Selection of one of these alternatives instead of S-11 would require a subsequent decision by the Regional Administrator.

Alternative S-11 was determined to be the most cost effective soils remediation alternative for the Site. As stated earlier, the alternative effectively prevents and minimizes the threats to, and provides adequate protection of the public health and welfare and the environment. While four alternatives (S-1, S-6, S-10 and S12) had lower costs than S-11, the degree of reliability was substantially less for each of them than the recommended remedial action. S-11 is the lowest cost alternative which eliminated the potential for direct contact and effectively minimized the effects of the freeze-thaw cycle and potential for exposure resulting from erosion. Alternatives higher in costs than S-11 involved establishing an impermeable cap or consolidation of the wastes. While these features are desirable they are considerably more expensive and are not necessary to protect the public health and welfare and the environment at this Site. Summarized below are the alternatives evaluated and the reasons why they were not selected as the recommended remedial action.

Evaluation of the alternatives reveals that they can be broken into four categories.

No or Minimal response

S-1,	No Action Alternative	$848,000
S-10,	Limited excavation, fencing, Deed restrictions	$3,593,000

Permeable Covers

S-4,	24" Fill, 6" Topsoil, Vegetate, Deed Restrictions	$9,453,000
S-6,	Limited excavation, 6" Topsoil, Vegetate	$5,323,000
S-11,	24" Fill, 6" Topsoil, Vegetate, Higher Action Level	$6,543,000
S-12,	6" Topsoil, Vegetate, Higher Action Levels	$4,253,000

Impermeable Covers

S-2,	24" Clay, 6" Topsoil, Vegetate, Deed Restrictions	$23,923,000
S-3,	6" Clay, 18 Fill, 6" Topsoil, Vegetate, Deed Restrictions	$13,575,000
S-5,	20 Mil Synthetic Membrane, 12" sand, 12" Fill 6" Topsoil	$12,703,000

Consolidation Actions

S-9,	Consolidate On-Site, Cap Deposits with 20Mil Synthetic Liner No Backfill	$10,253,000
S-8,	Consolidate On-Site, Cap Deposits with 20Mil Liner	$19,213,000
S-7,	RCRA On-Site Landfill	$80,253,000
S-13,	Removal & Off-Site Disposal	$209,680,000

Alternative S-1, the no action alternative, and S-10 limited excavation, fencing and deed restriction alternative, were rejected as inappropriate remedies for the Site. Both these alternatives were found not to meet the remedial objectives for the Site, nor would either meet or exceed applicable or relevant and appropriate Federal requirements. The RI determined that a substantial amount of waste deposits above the recommended levels were exposed or near surface. As a result, a direct contact potential existed. The S-1 Alternative clearly would do little to minimize or eliminate this potential. The S-10 Alternative, while taking positive steps to mitigate the short term direct contact potential by installing a fence around the exposed deposits would not provide for an effective long term means of preventing access to the Site and the exposed deposits.

In the five years since the initial installation of the fence, the Agency has made repeated attempts to repair damage to the fence resulting from vandalism. In the interim, unauthorized access to the Site continues. Implementation of either alternative would permit the continued release or threat of release of hazardous substances to the environment from the waste deposits located on Site.

For contrasting reasons, S-7 and S-13 were eliminated as the recommended remedial action. Implementation of these alternatives would produce significant short term adverse impacts to the surrounding area. In order for these alternatives to be completely effective, all the waste deposits would need to be excavated and redeposited into a secure facility. These alternatives were evaluated in terms of excavating and removing wastes from undeveloped portions of the property. Areas containing buildings, parking lots or roadways were not included as part of these alternatives. The physical problems and logistics associated with waste removal from under these structures is costly and impractical. Assuming that these deposits are allowed to remain in place, the effectiveness and driving force behind these alternatives is substantially reduced.

In addition to the logistical and implementation problems noted above, there are several short form adverse impacts associated with implementation of these alternatives. The RI determined that approximately fifteen percent of the sludge deposits are contained within the saturated zone. In addition, local surface waters are found in contact with the waste deposits at several locations. Excavation of the deposits will tend to suspend a portion of the waste material in the ground and surface waters. While engineering techniques can be implemented to minimize these potential impacts, the sheer volume of wastes to be excavated in order to successfully implement these alternatives makes the potential for a short term release very high.

Further, a significant amount of the material requiring removal as part of these alternatives are the animal glue manufacturing deposits. Past experience with the primary developer (Mark

Phillip Trust) indicates that disturbance of these deposits will cause a substantial release of odors. Release of these odors will pose a significant adverse impact to the public welfare surrounding the Site. As a result of the adverse impact to the welfare and the strong public resistence, the removal or rearrangement of the hide deposits is not feasible.

Costs associated with S-7 and S-13 are substantially higher than the next most costly alternative, S-8, which involves the excavation and on-site consolidation of waste deposits, capping the consolidated area with a 20 mil thick synthetic membrane and backfilling the excavated areas with clean off-site fill. S-8 costs approximately $24 million. S-7 costs $80 million while S-13, the off-site disposal option, would cost $209 million. Because S-8 was determined to be protective of the public health, welfare and environment and met the remedial objectives established for the Site, it would be considered acceptable as a remedial action. While the S-7 and S-13 alternatives are found to exceed the same criteria as S-8, the added costs would not produce a substantially better degree of protection than S-8.

The remaining alternatives basically can be classified as either in-situ containment or on-site consolidation and containment. The in-situ containment group can be further divided into permeable and impermeable covers.

Each alternative evaluated was found to meet or exceed the remedial response criteria for the wastes at this Site. Variations between alternatives evaluated in each subgroup were dependent on response level (action levels) and degree of reliability. The lower the response level and greater the degree of protection and reliability, the greater the costs. Briefly summarized below is a comparison of the remaining alternatives by subgroup.

Permeable Covers

This group includes alternatives S-4, S-6, S-11 and S-12. Costs ranged from $4.25 million for S-12 to $9.45 million for S-4. Each alternative in this subgroup was found to meet the remedial response criteria of minimizing or eliminating the direct contact potential. Each alternative was also found to meet applicable or relevant and appropriate Federal requirements. However, there was found to be a wide discrepancy in the degree of reliability provided by the alternatives in this group.

The lowest cost alternative in this group, S-12, involved remedial actions on areas found to be above the action levels established by the EA in the Feasibility Study. This alternative was rejected because it was determined to be only marginally protective of the public health, welfare and environment. While a six-inch topsoil cover would minimize the potential for direct contact, it is too thin of a layer to provide any degree of reliability. As discussed previously, the phenomenon of the freeze-thaw cycle plays an important role in the determination of the adequacy of the cover. Any material contained within the frost zone is susceptible to being forced to the surface by the freeze-thaw cycle. Given the substantial reworking of the Site, high groundwater table and the heterogeneous nature of the waste deposits, the potential for this cover to fail from the freeze-thaw effect is a distinct possibility. Roots of weeds, bushes and trees may penetrate through the cover to the waste and expose it. In addition, erosion and unauthorized site activities, such as all-terrain vehicles or motorcycles, will quickly penetrate the effectiveness of this cover. These weaknesses in the reliability of this alternative could be minimized by an aggressive operation and maintenance program as well as increased frequency of monitoring, but given that this remedial action must last indefinitely, this aggressive approach could prove unreliable.

Alternative S-6 is very similar to S-12 except the area requiring remedial action is increased as the result of a lower response level (100 ppm versus 300 ppm As, 600 ppm Pb, 1000 ppm Cr). This lower action level is a somewhat arbitrary level selected by the responsible party. Stauffer Chemical Company selected 100 ppm based on a literature review of ambient concentrations of metals found in soils, a reasonable detection level given the proposed analytical equipment and as a result of establishing a correlation between an analytical number and a visual observation in the field. Stauffer demonstrated that for the Site there was a good correlation between visual observations of potential waste deposits and values of metals above 100 ppm. This correlation is potentially very important because visual detection of areas requiring remedial action with occasional spot checking using analytical methods is much quicker and less expensive than determination of the limits of remedial actions solely through the use of analytical equipment. As a result, the FS evaluates most of the alternatives based on this lower number. Alternatives S-12 and S-11 are the exception in that they use numbers obtained from the EA.

The use of Alternative S-6 was rejected for the same reasons discussed in the evaluation of Alternative S-12.

Alternative S-11 attempts to overcome the deficiencies found in S-6 and S-12 by increasing the thickness of the cover material to thirty inches. Under this alternative the Site would receive a site preparation similar to previous alternatives. Placement of the cover material would commence with eighteen inches of permeable bank run gravel. An additional six inches of fine sieved sand is placed on top of the eighteen inches, followed by a six-inch topsoil cover upon which is established a vegetative cover.

Implementation of this cover will place the waste deposits below the mean frost level for this part of the region. The application of this type of cover has been deemed appropriate for asbestos landfills in Southern New Hampshire. The alternative is found to be protective of the public health, welfare and the environment by minimizing the direct contact potential. The cover is designed for a fifty to one hundred year design life. The cover will minimize the freeze-thaw cycle, eliminate root penetration by placement of the waste below the typical depth of root penetration (12 inches). In addition, erosion control of the cover can be maintained at regular intervals without the potential for accidental exposure.

Alternative S-11 is approximately $ 2.2 million more expensive than S-12. The majority of this additional increase in cost is directly related to the additional fill material required. The greater degree of reliability and protection resulting from S-11 more than offsets the increased costs.

Alternative S-4 is similar to S-11, except that it uses the lower action levels. Implementation of alternatve S-4 will provide a slightly greater degree of protection than S-11, except the alternative will cost an additional $ 2.9 million without providing a substantially greater degree of protection.

Impermeable Covers

Alternatives S-5, S-3, and S-2 are alternatives which provide a degree of impermeability. Each of these alternatives exceed the response objectives established for the Site. In addition to eliminating the direct contact potential, these alternatives prevent precipitation from leaching materials from the deposits and into the environment. The need for an impermeable barrier is not required for this Site. As noted in previous sections, the RI determined that waste deposits containing metals were not significantly impacting the ground or surface waters. A series of EP Toxicity testing further supported this conclusion. As a result, the installation of an impermeable barrier while further minimizing any leaching potential is unwarranted.

The FS evaluated three alternatives which provide a greater degree of impermeability. Of these three, two use a natural material, a bentonite soil mixture, and the remaining alternative uses a synthetic membrane to achieve its objective. In spite of the increased costs, the increase in environmental and public health protection is minimal. There are several reasons for this, each common to the three alternatives. The primary purpose of an impermeable barrier is to eliminate infiltration through a waste deposit. At this particular site a third of the area contains structures (buildings, parking lots and roadways) around which it would be impractical to establish and maintain a seal. Therefore, implementation of these alternatives would be jeopardized by the many gaps in the barrier. The effectiveness of an impermeable cover is based on the assumption that the wastes covered would remain above the saturated zone and as a result continued leaching would be eliminated. Site conditions are such that approximately fifteen percent of the deposits are contained in the saturated zone.

Alternative S-5 uses a 20 mil thick PVC synthetic membrane to maintain impermeability. This membrane is bedded between two six inch thick zones of sand. Twelve inches of common borrow material would be placed over the sand followed by a six-inch topsoil cover with vegetation established to control erosion. This alternative was found to be protective of the public health, welfare and environment. The alternative was rejected based on increased cost without a substantial increase in protection or reliability. In addition, the use of a 20 mil thick liner raises concerns about implementability and long term usefulness. Current Agency guidance would require a thicker membrane to resist construction hazards and increase its resistance to failure.

Alternative S-3 uses a six-inch thick layer of a bentonite soil mixture to maintain an impermeable cover. The impermeability would be protected by the placement of an additional 24 inches of cover materials. While this alternative was rejected for the same reasons as S-5, the use of only six inches of a bentonite soil mixture raises some concerns about the ability of the alternative to effectively meet its goals. The use of a bentonite soil mixture, mixed on-site, raises issues relative to the ability of the mixture to maintain its stated permeability. Changes in mixtures, moisture content, raw materials or site conditions can produce areas where there may be lenses of less impermeable material than required. This potential is minimized by increasing the thickness of the impermeable layer. Increasing the thickness of the layer also compensates for variations in application thickness and cracking resulting from shrinking and swelling of the clay as the moisture content changes.

Alternative S-2 attempts to minimize the problem associated with S-3, however costs increased from $13.6 million for S-3 to $24.9 million for S-2. This alternative was rejected because the $24.9 million cost when compared to the $6.5 million cost of an alternative deemed to meet the remedial objectives is unwarranted. Implementation of this alternative would have required some modification (with an associated cost increase) as part of the Remedial Design. The modification would be the addition of fill material between the six inch topsoil cover and the twenty-four inch clay layer. This additional soil would be required to protect the impermeable layer from the effects of evapotranspiration and penetration by the root structure.

Consolidation Actions

The two remaining alternatives, S-9 and S-8, involve the use of on-site consolidation with subsequent covering of the consolidated deposit. The alternatives are the same except that Alternative

S-9 does not require the excavated areas to be backfilled with clean material, while S-8 does.

In each alternative the elimination of the potential for direct contact is accompanied by a reduction in the physical area requiring remedial action. Under these alternatives, waste deposits are excavated from various portions of the Site and used to recontour and consolidate deposits onto a fifteen acre parcel already containing waste deposits. These alternatives have the advantage of minimizing the area requiring deed restriction, operation and maintenance and monitoring. This would "free up" land for future development. Consolidation options are attractive alternatives when there is a substantial reduction in area requiring additional controls. Site conditions, however, do not lend themselves to this attractive feature. As noted previously, the Site contains a number of structures, which indicated that waste material should remain in-situ. As a result, while reducing the areas which required ongoing O&M and monitoring, this alternative would leave behind a number of discrete satellite deposits under the structures which would still require institutional controls and monitoring. This fact destroys the primary feature of the consolidation option. In addition, once the material is excavated, it is typically deposited into some sort of engineered structure, such as a RCRA landfill. By placing the material into a RCRA landfill the waste can be carefully controlled to eliminate the potential for future release. Under this alternative the waste does not receive full benefits of the consolidation option, such as a bottom liner or leachate collection system.

Site conditions and the level of protection required at the Site does not warrant the increased costs for only a small increase in protection associated with these alternatives. The primary advantage gained from this group of alternatives is minimizing the area requiring deed restrictions and freeing up land for additional development. In addition to these concerns, Alternative S-9 does not require backfilling of the excavated areas. While this substantially reduces the costs ($10.25 million versus $19.21 million), it allows the Site to remain in an unacceptable condition. Area requiring excavation may reach depths in excess of fifteen feet below grade. These areas would quickly fill up with precipitation and groundwater, thereby creating an attractive nuisance.

Operation and Maintenance costs for the soils alternatives are found on Tables 42 and 43, and the capital, operation and maintenance and present worth costs are summarized on Table 52.

RECOMMENDED REMEDIAL ACTION FOR AIR

Listed below are the six alternatives evaluated in detail for remediating the problems posed by the East Hide Pile. Present worth costs for each alternative also provided.

	Alternative	Present Worth Costs
A-1	No Action (Monitoring Only)	$171,000
A-2	Dewater the wetlands, stabilize slope, cover with 20 mil synthetic membrane, vegetate, deed restrictions	$2,030,000
A-3	Dewater the wetlands, stabilize slope, install gas collection/ blower system, cover with 20 mil synthetic membrane, vegetate, activated carbon treatment, deed restrictions	$2,799,300
A-4	Dewater the wetlands, stabilize slope, install gas collection/ blower system, cover with 20 mil synthetic membrane, vegetate, thermal oxidation treatment, deed restrictions	$3,109,000
A-5	Excavate and remove East Hide Pile, dispose of in on-site RCRA landfill with gas treatment systems as in A-3 or A-4	$15,510,000
A-6	Excavate and remove East Hide Pile, dispose of at off-site RCRA landfill	$35,860,000

A modified version of alternative A-3 or A-4 will be selected as the most cost effective remedial action that mitigates the threats to, and provides adequate protection of public health and welfare and the environment. These two alternatives offer equivalent degrees of protection and reliability. The final solution of an alternative that will mitigate the odor impacts will be made by the Regional Administrator in a supplemental decision document. This decision will consider results of a monitoring study conducted subsequent to installation of the impermeable barrier and gas collection system. Final selection of gas treatment offered by alternatives A-3 or A-4 will be made after evaluation of gas emission rates from the pile once the impermeable barrier is in place and the pile has had time to stabilize. The FS indicated that the piles would reach equilibrium in approximately seven weeks. The Agency will assess degree of pile equilibrium after monitoring pile gas generation. The Agency will design and implement a monitoring plan capable of measuring the rate of pile stabilization by observing gas flow rate and gas concentration. The monitoring shall continue until the Agency can adequately determine which gas treatment alternative will be the most efficient and cost effective and provide a long term odor emission remedy. During the monitoring program a temporary treatment system shall be installed to minimize or eliminate the potential release of obnoxious odors. Prior to a final decision the Agency shall make available the data and rationale for the gas treatment option selection and an explanation supporting the Agency's decision.

A major engineering concern during design and implementation of alternative A-2 or A-3 is preservation of the environmental integrity of a shallow pond and associated wetlands. The wetlands are approximately four acres in area and are located between the East and West Hide Piles. Either alternative as illustrated in the FS requires that these wetlands and pond be filled and a drainage system installed to dewater the pond, wetlands and the local groundwater. The destroyed pond would be filled and provide more area to establish three to one side slopes on the East and West Piles. A primary reason for draining the pond and wetland is to lower the local groundwater table to lower the groundwater mound within the hide piles. The FS concluded that fluctuation of the groundwater mound complicated gas treatment process operation. The FS also concluded that the greatest reduction of the groundwater mound would be accomplished by dewatering and lowering of the groundwater table. It concluded that installation of a synthetic membrane to cap the pile would not effectively result in a significant mound reduction and destruction of the pond and wetlands needed to be part of successful implementation of the recommended remedial alternative.

The Agency disagrees with the conclusion for the need to dewater the pond and its associated wetlands. Executive Order 11990 concerning wetlands prohibits the elimination of wetlands except in specific and limited circumstances. The Agency, through this Executive Order and § 404 of the Clean Water Act recognizes the value and importance of wetlands and the need to protect them from destruction. It is the Agency opinion that the circumstances and data concerning the wetlands and hide piles do not support the need for wetlands elimination. The Agency agrees that the approach outlined in alternatives A-2, and A-4 would ensure maximum dewatering of the piles. In addition, the Agency agrees that the proposed dewatering would enhance remedial action reliability as well. However, the Agency believes that other techniques employing common engineering practices that will provide adequate protection, meet the odor control needs, and provide protection of welfare will not substantially impact the wetlands. The Agency will modify the FS recommended alternatives during the Remedial Design process to balance the need to eliminate odors and to protect wetlands. As part of the supplemental FS, Stauffer submitted a Wetlands Assessment in which an alternative to minimize the impact on the wetlands using sheet piling was evaluated. The use of sheet piling to stabilize the side slopes while minimizing the impacts to the wetlands was deemed to be an appropriate method for addressing the requirements of §404(b)(1). However, Stauffer rejected use of this alternative based on their determination that dewatering the piles by eliminating the groundwater mound was the most important criterion. As noted previously, the Agency rejected Stauffer's conclusion and as a result believes that the use of sheet piling is an effective technique for implementing more aggressive slope stablization techniques in order to protect the wetlands. A moderate increase in the sizing of the treatment system will accomodate any additional gas production resulting from the increased moisture contained within the pile. Figures 15 and 16 show the details of the sheet piling technique.

In addition, as part of the remedial design, the Agency will design and implement a monitoring plan capable of accurately measuring the rate of stabilization, the gas flow rate, and the gas concentration. Action levels and a contingency plan will be established in the design phase. If concentrations approach the action levels, the contingency plan will be implemented to protect the public health. The monitoring shall continue until such time as the Agency can adequately predict which alternative will provide the most efficient, cost effective long term remedy to the emission of odors. In the interim, a temporary treatment system (such as activated carbon) shall be installed to minimize or eliminate the potential release of obnoxious odors during the monitoring program.

Alternative A-1, the no action alternative was rejected because it did not meet the remedial objectives to eliminate odor or to conform with the applicable or relevant and appropriate public health and environmental requirements. No action at the Pile would maintain current Site conditions with wastes at or near the surface of the Pile and wastes brought to the surface by the continued sloughing and erosion of the Pile. These conditions would continue to pose a direct contact hazard to the public. The unabated emission of odors from the Site would continue to threaten the public welfare. Allowing continued release of odors would violate relevant and appropriate state standards for the control of air pollution. The continued sloughing and eroding of contaminated material into the wetland and surface water would violate the applicable or relevant and appropriate requirements of the CWA and Executive Order 11990. The FS did not present and the Agency has not been able to identify a remedial alternative addressing the Hide Pile problem that does not adversely impact the wetland because Hide Pile wastes were deposited directly in the wetland. In the absence of any alternative that can avoid wetland impacts, an alternative that minimizes these adverse impacts would conform with the Executive Order 11990.

Alternative A-2 recommended stabilization of pile side slopes and trapping the odorous gases under an impermeable membrane cap. This alternative was rejected because it did not adequately protect public welfare or mitigate threats to the environment. Slope stabilization and the impermeable cover will substantially reduce the pile moisture content and reduce microbial action that generates gases; however, gas production would continue after installation of an impermeable cover and would remain a significant concern. Numerous investigations of municipal landfills have provided information concerning gas production rates and possible uses for the gas generated at municipal landfills. Methane gas production at several landfills is sufficient to justify extraction for commercial uses. Gas production, negative impacts and the associated odors are not adequately addressed by alternative A-2. Methane gas (a major component of the gases) can be generated in significant quantities in the pile to result in decreased cap integrity due to physical ballooning or cover distortion and gas may reach explosive concentrations.

Alternative A-5, proposed excavation of the pile and disposal in an on-site RCRA landfill. This alternative was rejected because it cost $15.5 million and its impacts on the environment and the public welfare are unacceptable. Excavation of the pile will necessarily release intense, obnoxious odors into the environment, adversely impacting the public welfare. Neither the Agency nor the DEQE knows of any method which will reliably control or eliminate the odors generated by excavation. The odors are so intense, the problem so long-standing and the community opposition to the odors so high that the Agency would face strong community opposition and possibly litigation, if this alternative were chosen.

Implementation of A-5 would adversely impact wetlands, surface water quality and possibly groundwater quality. Releases of waste to surface and groundwater as well as destruction of the wetlands by access roads built and sheet piling installed in the wetland would occur during implementation of this alternative. Further, worker safety would be a major concern as a result of the attendant releases of hydrogen sulfide and methane gas, presenting the possibility of poisoning or asphyxiation.

The Agency finds that alternative A-5 is not protective of the public welfare nor in conformance with relevant and appropriate regulations. Further, the Agency has determined that this remedy is not more cost effective because it is five times more costly than the recommended remedial actions.

Alternative A-6 proposed excavation of the Hide Pile and its disposal at an off-site RCRA facility. This alternative was rejected because it costs $35.8 million and its adverse impacts to the environment and public welfare are unacceptable. This alternative would include negative environmental impacts similar to those discussed for alternative A-5 and the impacted public would expand to include those people along the waste transport route and near the disposal facility as well as those near the Site. The cost of this alternative is more than double that of alternative A-5 and an order of magnitude greater than that of the recommended remedial action.

RECOMMENDED REMEDIAL ACTION FOR GROUNDWATER

Listed below are the four alternatives evaluated for remediation of the groundwater contamination.

	Alternative	Present Worth Costs
GW-1	No Action Alternative Quarterly Monitoring Only	$850,000
GW-2	Groundwater interception/recovery of on-site "hot spot" areas, treatment with subsurface discharge	$2,960,000
GW-3	Groundwater interception/recovery at Site boundary, treatment with surface water discharge	$4,220,000
GW-4	Groundwater interception/recovery at leading edge of plume, treatment with surface water discharge	$11,150,000

Of the four alternatives, only GW-4 meets the applicable or relevant and appropriate Federal public health and environmental requirements. By capturing all the contaminants found in the groundwater from the Site, this alternative would theoretically restore the aquifer to a pristine condition. Selection of alternative GW-3, capture and treatment at the Site boundary might also be protective of the public health and welfare and the environment as well as potentially complying with the applicable or relevant and appropriate requirements. Alternative GW-3 would capture and treat approximately ninety percent of the plume, allowing the remaining ten percent to further migrate off-site and downgradient. The remaining concentrations might meet RCRA standards by establishing an ACL for the groundwater at the Site boundary.

Pursuant to §300.68(i)(5)(i) of the NCP, the selected remedy for groundwater is alternative GW-2. This remedy is an interim remedy until a determination as to the most effective solution to an area-wide groundwater contamination problem can be made. As briefly summarized in the Current Site Status section, the Agency has knowledge of a number of actual and potential sources adversely impacting the groundwater surrounding the Site. Upgradient of the Site are several active industrial operations, each with an ongoing groundwater problem. Abutting the Site to the west and northwest are a large municipal landfill, two barrel reclamation operations, two chemical manufacturers and two large trunk sewer lines with a long history of surcharging. In addition to these actual and potential groundwater impacts, southwest of the Site is a company with a fuel oil problem impacting the groundwater.

Each of these problems is contributing to the general degradation of the groundwater quality in this portion of the aquifer. Farther downgradient, the portion of the aquifer serving Wells G and H has a separate groundwater contamination problem. Investigations into the potential impacts on groundwater from the above noted sources are ongoing.

Because the scope, direction and pace of each of these investigations if different, there is a potential that decisions regarding groundwater remediation may be inconsistent with the overall goals of the Ground Water Protection Strategy. Current CERCLA guidance recognizes that specific decisions about groundwater remedial actions resulting from a CERCLA site should be made in conjunction with the resolution of the larger area-wide groundwater problem. As a result, CERCLA guidance permits the selection of an interim remedy until a more comprehensive investigation of the area-wide groundwater problem can be completed. This investigation is referred to as a Multiple-Source Ground Water Response Plan (MSGWRP).

The Agency believes that the implemention of a MSGWRP is required prior to a final decision as to the extent of the groundwater remediation at the Site. The Agency further believes that the MSGWRP is the most efficient response to the remediation of the groundwater problems associated with the Site as well as the larger problems within the aquifer.

Based on the preceding determination the Agency believes that implementation of alternative GW-2 is the most cost effective response to minimize the impacts to the public health, welfare and environment while resolving the larger regional problem. Under this alternative the FS estimated that eighty percent of the benzene and slightly less of toluene would be captured within a six to nine month period through careful placement of recovery well systems. Three of the four alternatives seek to control and minimize the impact on groundwater resulting from the benzene plume. Alternative GW-1, the no action alternative, does nothing to minimize the potential impact on the downgradient aquifer supplying Wells G & H, it only seeks to monitor the plume's downgradient migration. Depending on the length of time necessary to design, implement and reach a decision on the multiple source groundwater response plan this alternative may be an appropriate response to the on-site groundwater problem. The implementation of GW-2 appears to be the most appropriate interim remedial action under the present Site conditions. Alternative GW-2 seeks to capture and treat approximately 80% of the contaminant of concern (benzene) within a relatively short time frame (less than 6 months). Using GW-2 as the interim remedy take positive steps in a cost effective manner to minimize the impacts to the off site public health and environment while permitting the MSGWRP to create a long term response plan for remediation of the aquifer. The ease of implementation, its short operation period, and its containment of the majority of the plume make it ideal as an interim groundwater remedy.

While GW-3 and GW-4 provide a greater degree of protection for the public health and welfare and the environment than the previous two alternatives, they are not appropriate as interim remedies. The primary purpose of an interim remedy is to undertake an action which will provide the maximum degree of protection at the least cost while additional studies are undertaken to ensure that any long term remedial action at a site is consistent with the larger environmental goals associated with the aquifer. In the case of GW-3 and GW-4 the substantial period of operation (10+ years) and increased capital and operation and maintenance costs make them unsuitable as interim remedies.

VIII. OPERATION AND MAINTENANCE (O&M)

A key component of any remedial action is the development and implementation of an effective operation and maintenance (O&M) program. This program will ensure that the effectiveness of the remedial actions is maintained through periodic monitoring, inspection and preventative maintenance. A major part of any effective O&M program is a sampling and analysis effort. The sampling plan is intended to provide the basis for determining the effectiveness of the remedial action and to serve as an early warning system should the remedial action begin to fail. In addition, the monitoring program helps to track the rate of remediation (when applicable) and assists in the decision to modify the operating parameters of a remedial action to provide for a more efficient clean-up or better protection.

For each remedial action selected, there are proposed O&M and monitoring costs associated with it. Costs for the soils alternative S-11 are on Table 42, those for air are on Table 49, 50 and 51, while costs for groundwater are located on Table 22. Monitoring costs associated with the overall Site are summarized on Table 43. Summarized briefly below is a description of the O&M tasks associated with each recommended remedial alternative.

SOILS

The O&M tasks associated with the soils alternative are simple and straightforward to implement. Basically, the costs include an annual inspection to visually determine that the cap's integrity is intact. Any area requiring repair would be covered with additional fill material in order to eliminate the potential for direct contact. This annual inspection would typically be performed in the spring in order to determine the effects on the cap from from the freeze-thaw cycle. This detailed inspection would record in writing the physical integrity and condition of the cap. Records of these inspections would be retained in order to evaluate the long-term performance of the remedial actions and to identify areas potentially requiring future preventative maintenance. Less intensive periodic inspections would be conducted as needed, such as after a particularly severe rainfall when the erosion potential is high.

Costs associated with maintenance include a twice yearly mowing of the vegetative cover, patching and repairing erosion gullies and covering areas subjected to the effects of the freeze-thaw cycle. Periodic bush and tree removal, as well as re-seeding portions of the vegetative cover will be performed as necessary.

Responsibility for periodic O&M on developed areas would lie with the existing property owner. Ensuring compliance with the terms of the O&M will be the responsibility of the controlling regulatory agency.

The actual nature and scope of the O&M plan will be developed and approved as part of the Remedial Design process; however, the general outline of the program will comply with requirements set forth in RCRA Part 264 Subpart G - Closure and Post Closure and Subpart N - Landfills.

AIR

Operations and maintenance for the recommended remedial action are broken into three parts: maintenance of the impermeable cover, O&M of the gas collection system, and the O&M of the gas treatment system.

For the first part, O&M will include periodic inspections of the impermeable cover system. Specifically, actions will include detection of subsidence and slope stability poblems. As proposed, the western toe of the slope will be secured using sheet pilings driven into the bottom of the pond. The area behind the pilings will be backfilled with clean material which serves as a base to anchor the synthetic membrane. Periodic maintenance of the sheet pilings will be required to ensure that the toe of the slope resists the effects of sheer failure resulting from the relatively steep side slopes. Similar to periodic maintenance requirements under the soils alternative, mowing the vegetative cover as well as repairing seeded areas are included in the cost of the O&M plan.

The second part of the O&M under this alternative is the periodic maintenance associated with the gas collection system. Costs and actual maintenance on the below cap collection system is projected to be minimal; however, there are electrical and maintenance expenses associated with the blower system. The blower system is designed to actively withdraw gases from the pile; this requires a positive induction fan. These fans are very common, are widely used and are easy to maintain and operate. Projected maintenance would include periodic inspection, lubrication and adjustment.

The final phase of the O&M requirements under this alternative is the operation and maintenance of the gas treatment system itself. Specific requirements are dependent upon the selection of either A-3 or A-4; however, the general type of requirements are found on Table 50 for A-3 and Table 51 for A-4. It should be noted that either treatment system will require a part-time treatment plant operator. Costs associated with the treatment plant operator are illustrated with the groundwater alternatives.

GROUNDWATER

The operation and maintenance (O&M) requirements for the treatment of groundwater include the periodic maintenance of the interceptor well system. Costs primarily associated with this portion of the system are the electrical utility costs for operating the pumps. Periodic maintenance for the pumps may include occasional rebuilding or replacement of the pumps themselves and maintaining the piping system and flow meters.

A part time plant operator will be required to ensure that the treatment system is operating properly and in compliance with established operating parameters. Tasks include periodic replenishment of chemicals used in the odor control process, adjustment of flow rates to maximize the efficiency of the air stripping system and periodic inspection and maintenance of the subsurface discharge system. Other costs associated with the treatment system include chemical and electrical costs as well as plant operator salary.

MONITORING

A comprehensive sampling and analysis program will be developed and implemented as part of the Remedial Design process. The primary purpose of this program is to monitor the overall effectiveness of the implemented remedial actions. Economy of scale can be attained by developing a single program maximizing the number and locations of monitoring points to address more than one media. This approach provides the added advantage of integrating the three proposed remedial actions by looking at sampling results in light of the entire site. The program will include sampling and analysis of ground and surface waters, soils and air. Also included will be sampling and analysis of various points within the groundwater and air treatment systems to assist the Agency in maximizing the efficiencies of the systems.

Table 43 illustrates the level of effort and costs associated with the sampling plan. The table indicates a semi-annual frequency rate; however, the Agency believes that quarterly monitoring for the environmental parameters and more frequent monintoring for the process analysis is required. The actual development and implementation of the monitoring plan will be consistent with requirements set forth in Part 264 of RCRA.

IX. SCHEDULE

Listed below are key milestones and dates for successful implementation of this project.

Approve remedial action (sign ROD)	September 30, 1986
Complete Enforcement Negotiations	January 1, 1987
Send Interagency Agreement (IAG) to Army Corps of Engineers for Design	January 15, 1987
Start Remedial Design	February 15, 1987
Start pre-design field studies	March 1, 1987
Complete Remedial Design	November 15, 1987
Amend IAG for construction	November 15, 1987
Start construction	December 1, 1987
Complete construction	October 1, 1989

This schedule is dependent on the availability and obligation of funds to implement the project design and construction. The time lag before obligation of final remedial action funds will protract the schedule for implementation by an equal length of time.

X. FUTURE ACTIONS

This Record of Decision encompasses all remedial actions necessary to protect the public health, welfare and environment. However, a number of additional actions necessary to ensure the successful implementation of the remedies will be undertaken.

Additional field investigations as part of the Remedial Design will need to be undertaken to resolve the following issues.

- Additional soil borings and test pits to more accurately characterize the extent and distribution of waste deposits within the developed areas requiring remedial actions and areas receiving institutional controls only.
- Additional soil borings and test pits south of the original Site area (as defined by the Consent Order). Specifically the Right of Way Number 9 owned by Boston Edison will be the focus of this additional effort. Data collected will be used to calculate quantities of fill material necessary to implement a remedial action.
- Additional soil borings and monitoring wells in the vicinity of the East Hide Pile. This additional effort will be used

to identify the exact requirements necessary to establish a firm base at the toe of the East Hide Pile to minimize the effects of the slope failure. This additional information is critical to ensuring that the impact to the wetlands is kept to an absolute minimum. The installation of the monitoring network will develop a better base of monitoring data on the impacts resulting from the East Hide Pile.

- Additional groundwater sampling and monitoring to more accurately characterize the "hot spot" areas.

This additional testing will be used in pilot studies on the treatability of the groundwater as well as assisting in the development of operating parameters such as pumping rates, location of interceptor wells and period of performance.

Because the Agency has selected an interim groundwater remedy prior to resolution of the area-wide problem it is important that the development and implementation of the Multiple Source Ground Water Response Plan (MSGWRP) begin as quickly as time and funding will allow. The actual form of the MSGWRP is not yet fully defined. The Agency believes that the formalization of the plan will come as a result of ongoing discussions with the DEQE and the City of Woburn. This formalization perod is expected to take approximately six months; however, implementation of the actual plan is dependent on the reauthorization of CERCLA.

A subsequent decision by the Regional Administrator on the long term groundwater remedial action will be required. It is envisioned that this decision will be in the form of a Record of Decision and will be based in part on the conclusions from the MSGWRP.

As noted previously, a subsequent decision by the Regional Administrator on the air treatment system will be required. This document will briefly summarize the results of the monitoring program conducted on the venting system from the East Hide Pile and recommend either A-3 or A-4 as the more cost-effective alternative. The document will not be a ROD document, but a memo documenting the selection of one of two equally acceptable alternatives based on field data.

The Agency selected a soils remedial action which requires the placement of thirty inches of clean fill materials to eliminate the potential for direct contact. As part of the public comment period, Monsanto Chemical Company, a responsible party submitted a lengthy document critiquing the RI/FS. While Monsanto generally agreed with the overall approach and extent of the proposed remedy, it felt that thirty inches of cover material was unnecessary and excessive. Monsanto in its public comments indicated that twelve inches of cover material was more appropriate and has subsequently increased its estimated thickness to fifteen inches. The Agency selected the thirty inch cover options based on experience gained by the covering of asbestos landfills to eliminate the potential for direct contact in Southern New Hampshire.

The Agency recognizes that other engineering solutions to eliminating both the short and long term problems exist for application at the Site. These other engineering solutions may in fact be equivalent to the selected remedial alternative pending additional investigation and evaluation. The additional documentation and rationale for the fifteen inch engineered cover proposed by Monsanto was not available prior to close of the public comment period. As a result, it is premature for the Agency to comment on the efficacy of Monsanto's proposal. If subsequent review and evaluation of the Monsanto proposal determines that it is equally protective of the public health, welfare and environment, meets the criteria established in the ROD and is more advantageous to implement in terms of costs, implementability and reliability the Agency would request subsequent approval by the Regional Administrator prior to completion of the Remedial Design process.

Future actions also include monitoring the effectiveness of the cap, groundwater and air treatment systems as well as assuring future effectiveness of these actions through proper operation and maintenance. Monitoring for cap effectiveness is required under 40 C.F.R. Part 264 Subparts F and G and Subpart N §264.310(b).

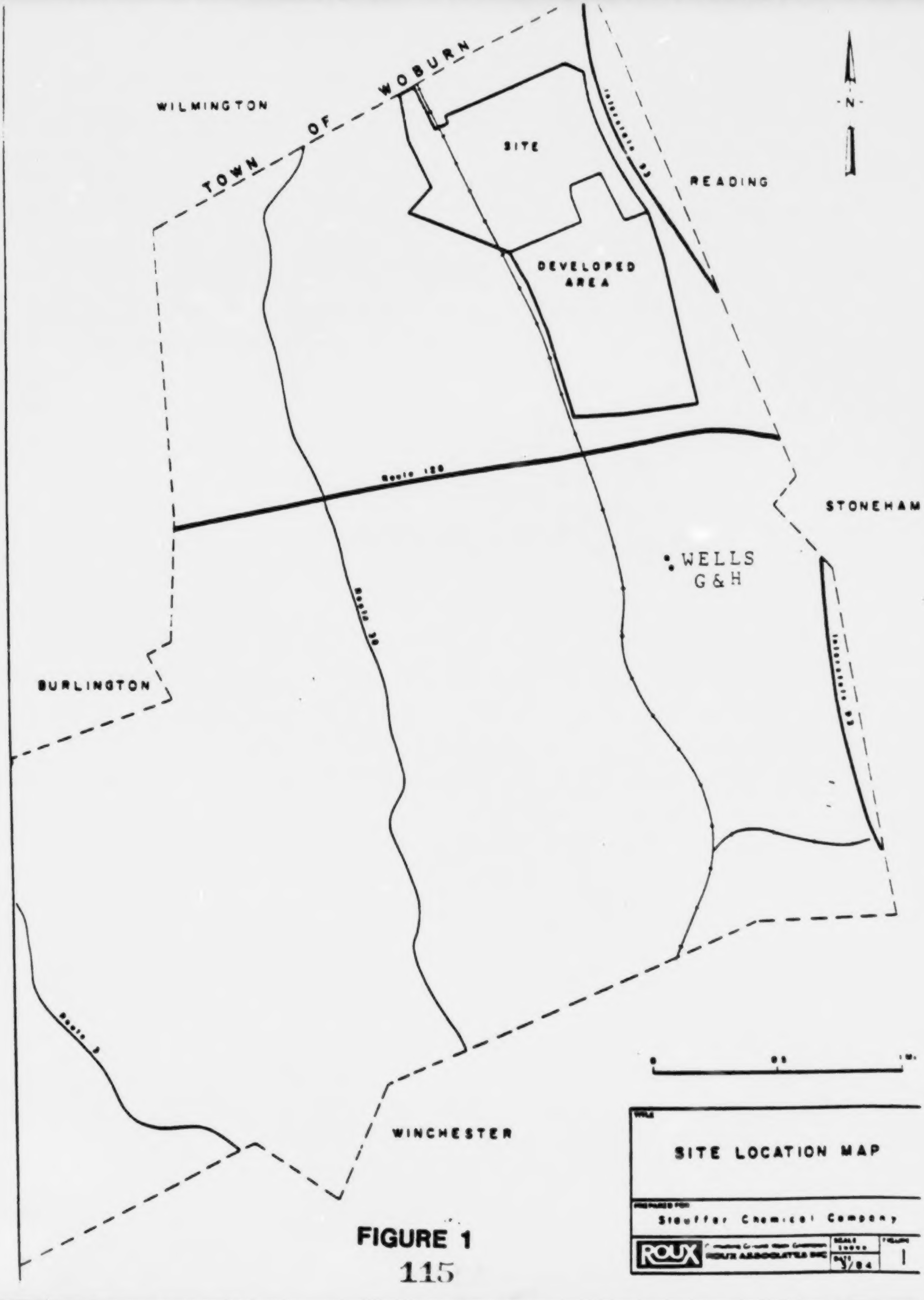
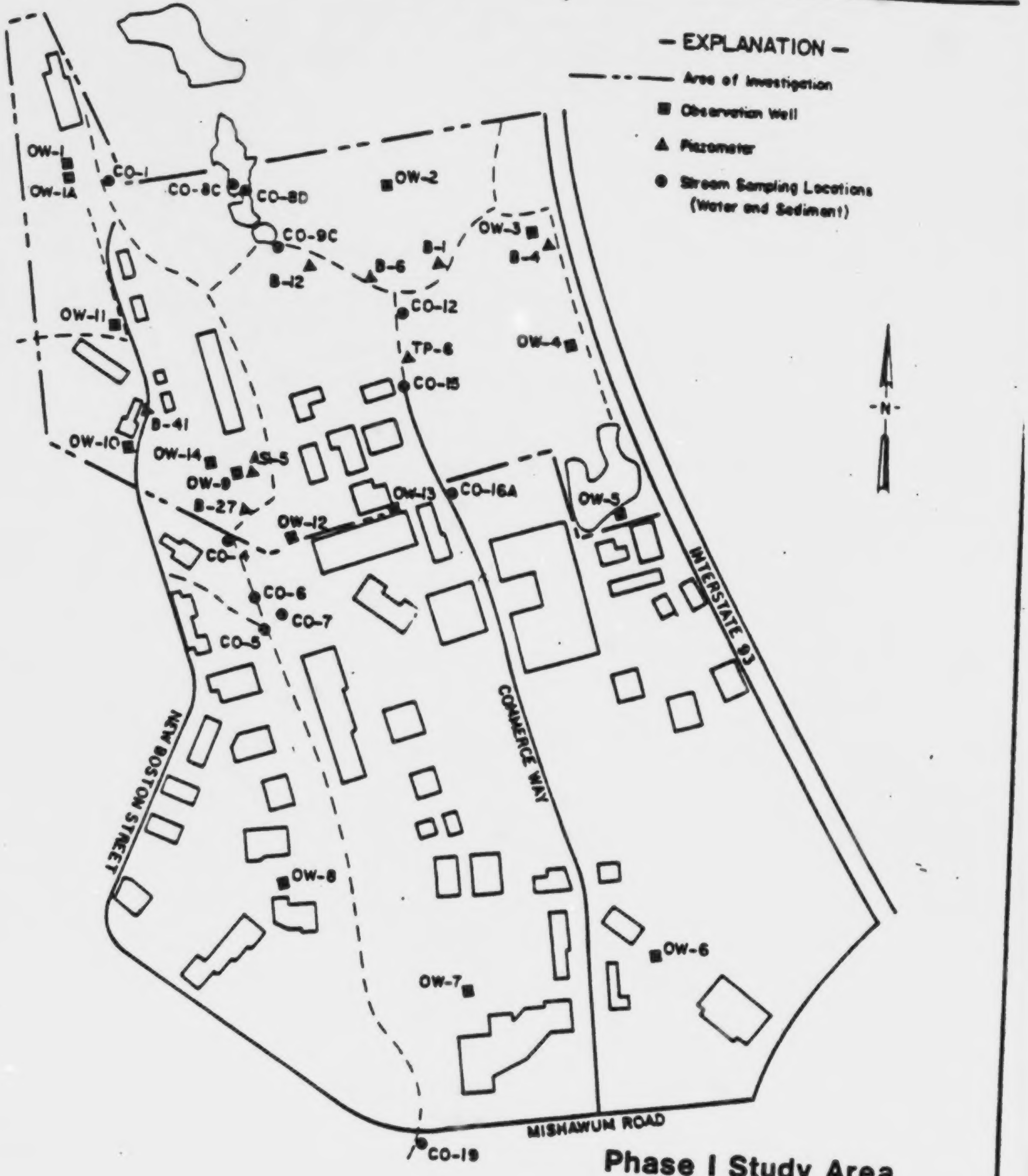

N
WILMINGTON
TOWN OF WOBURN
SITE
READING
Interstate 93
DEVELOPED AREA
Route 128
STONEHAM
WELLS G&H
Route 38
BURLINGTON
Interstate 93
Route 3
WINCHESTER
0
0.5
1 Mi.
SITE LOCATION MAP
Stauffer Chemical Company
ROUX
ROUX ASSOCIATES INC
3/84
1

FIGURE 1

FIGURES

INDUSTRI-PLEX SITE
Woburn, Massachusetts

September 1986



Phase I Study Area

TITLE

OBSERVATION WELL
LOCATION MAP
(With Stream Sampling Points And Piezometers)

PREPARED FOR

Stauffer Chemical Company

ROUX Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

SCALE 1" = 823'

DATE Feb 1983

FIGURE

FIGURE 2

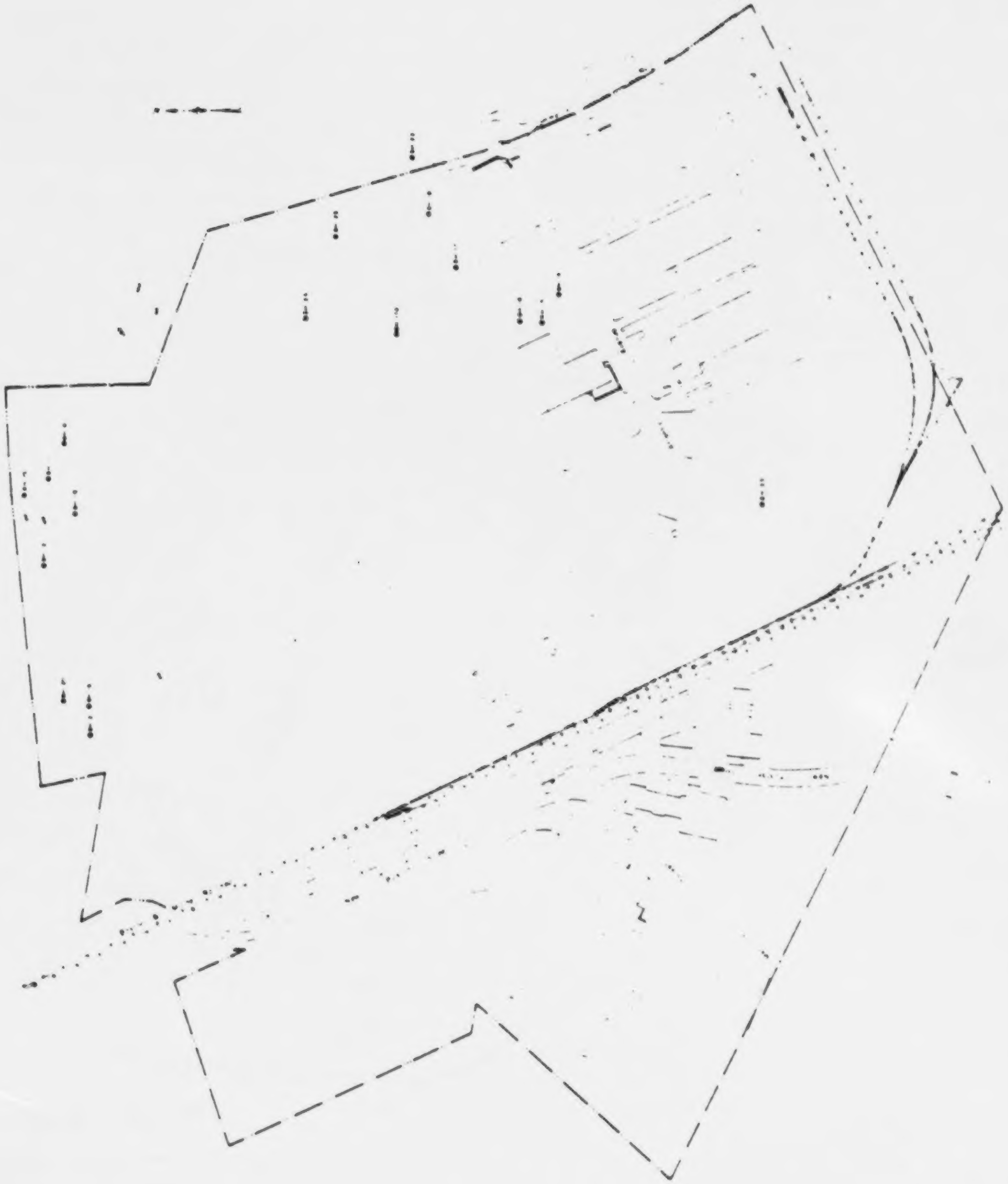
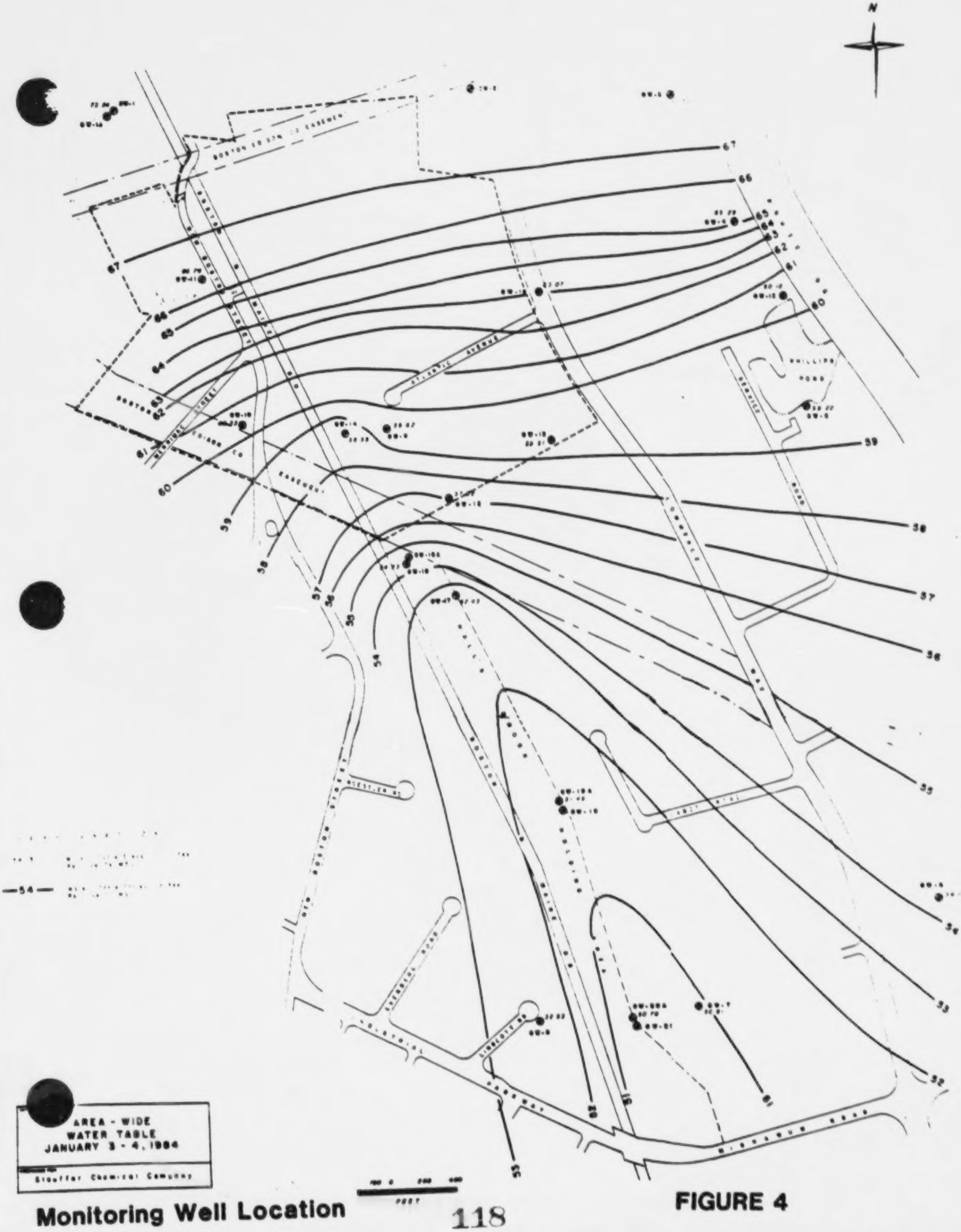


FIGURE 3

Phase II Study Area



Monitoring Well Location

FIGURE 4

>100 PPM CR, PB OR AS IN SOIL

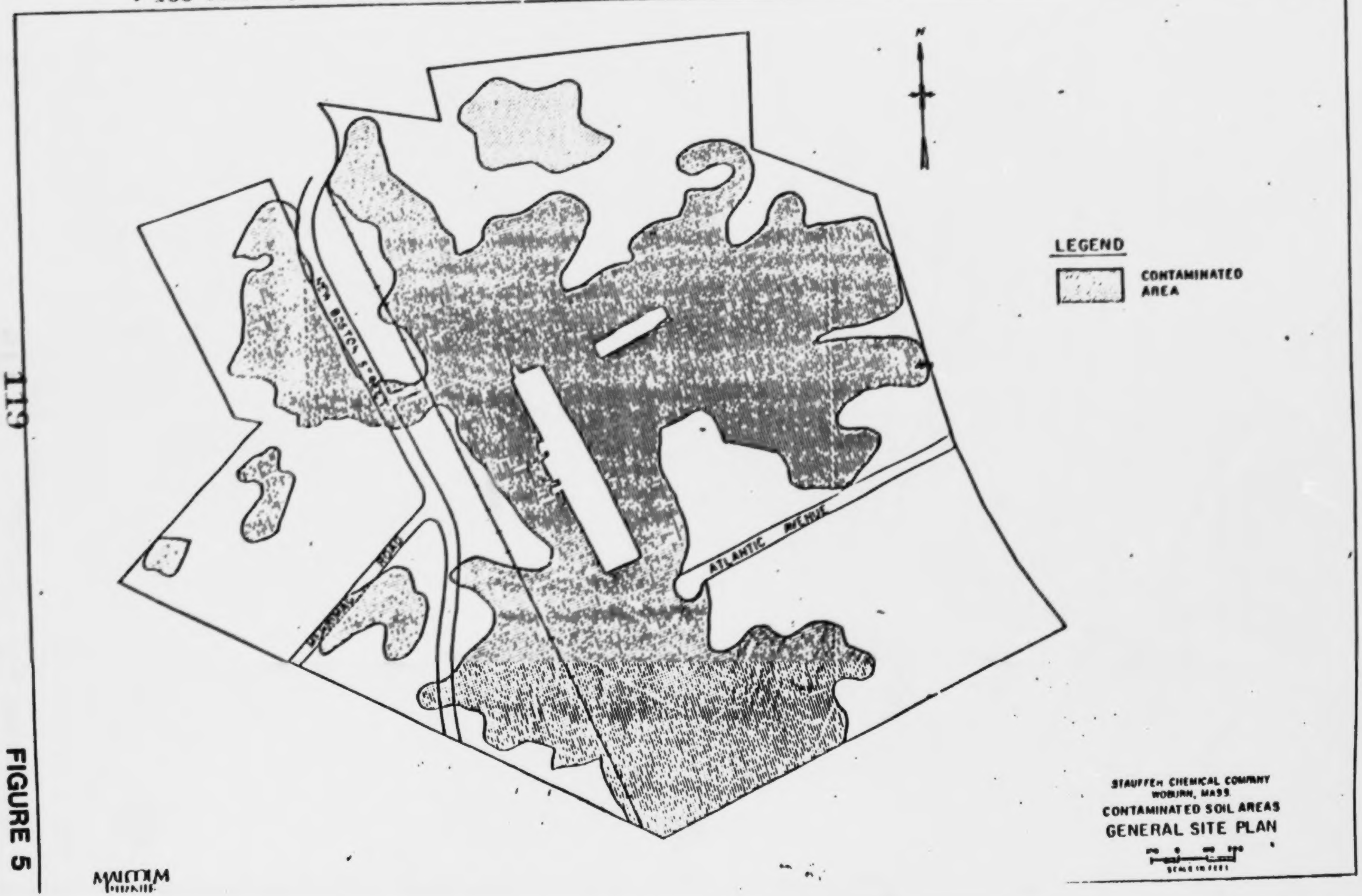


FIGURE 5

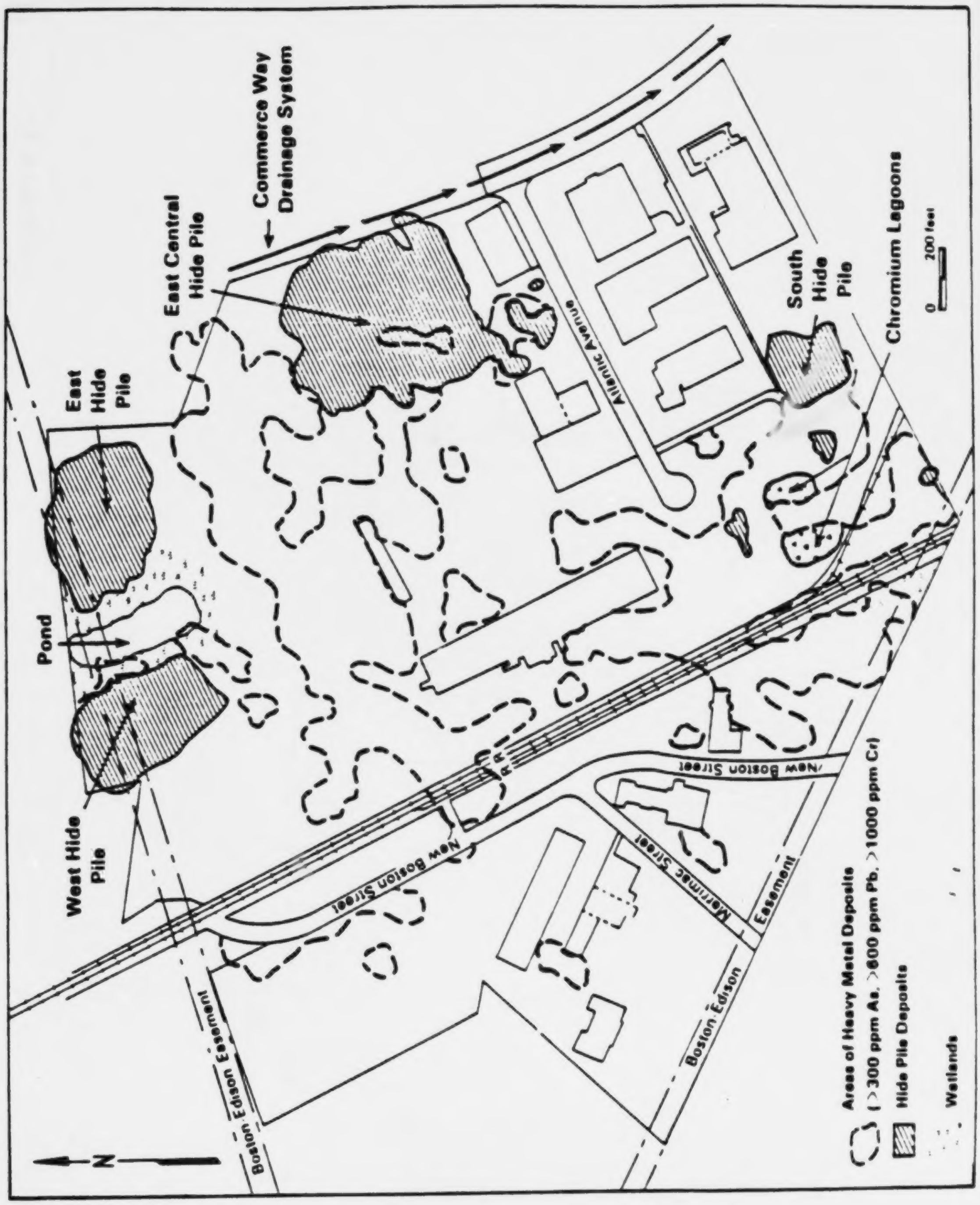
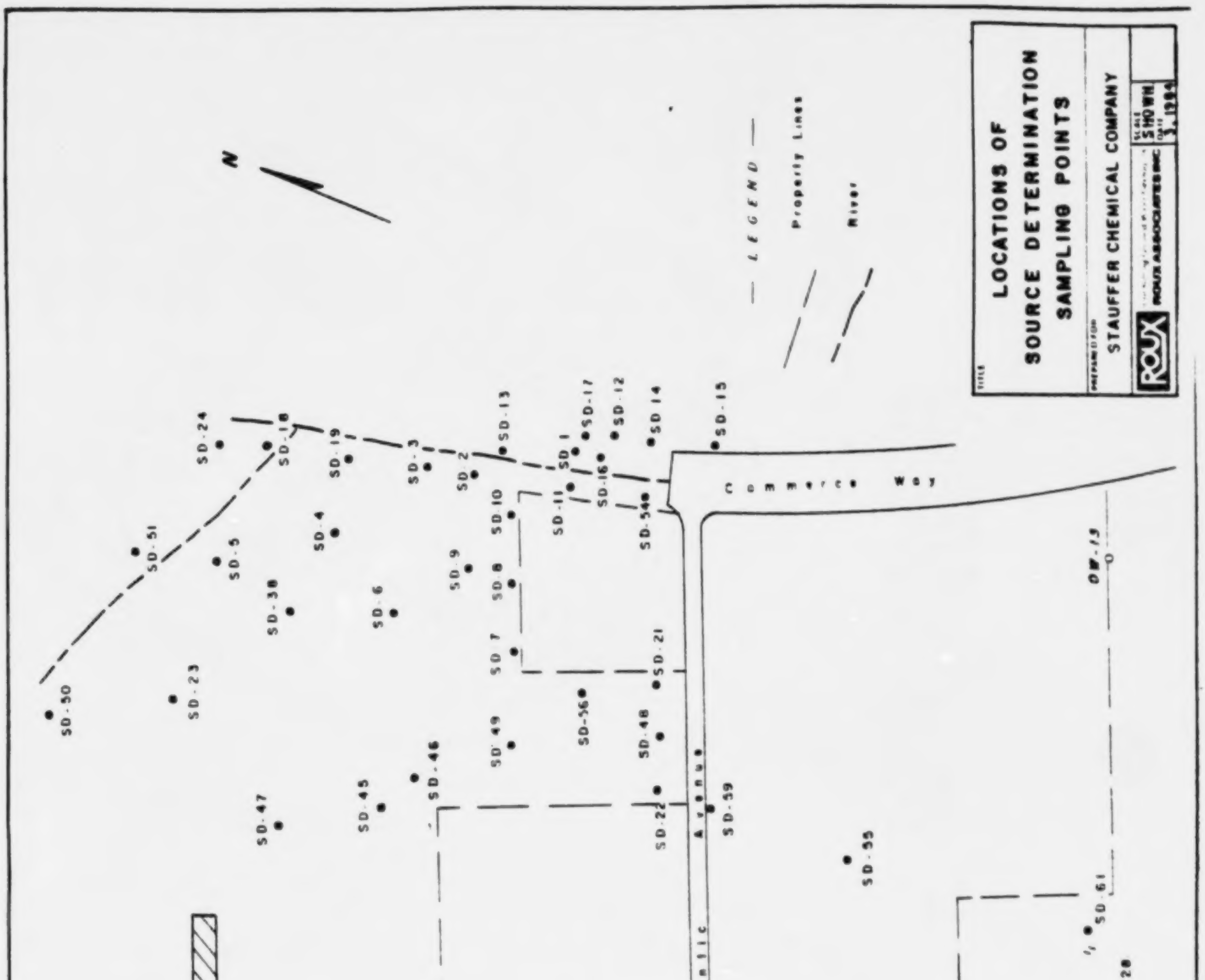

Commerce Way Drainage System
East Central Hide Pile
East Hide Pile
Pond
West Hide Pile
South Hide Pile
Chromium Lagoons
Atlantic Avenue
New Boston Street
Merrimac Street
Easement
Boston Edison Easement
RR
N
0 200 feet
Areas of Heavy Metal Deposits (>300 ppm As, >600 ppm Pb, >1000 ppm Cr)
Hide Pile Deposits
Wetlands

FIGURE 6


LOCATIONS OF
SOURCE DETERMINATION
SAMPLING POINTS
PREPARED FOR
STAUFFER CHEMICAL COMPANY
ROUX
ROUX ASSOCIATES INC
SCALE SHOWN
DATE 1984
N
LEGEND
Property Lines
River
Commerce Way
Atlantic Avenue
OW-13
OW-12
SD-1
SD-2
SD-3
SD-4
SD-5
SD-6
SD-7
SD-8
SD-9
SD-10
SD-11
SD-12
SD-13
SD-14
SD-15
SD-16
SD-17
SD-18
SD-19
SD-21
SD-22
SD-23
SD-24
SD-25
SD-26
SD-27
SD-28
SD-29
SD-30
SD-31
SD-32
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SD-35
SD-36
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SD-39
SD-40
SD-41
SD-42
SD-43
SD-44
SD-45
SD-46
SD-47
SD-48
SD-49
SD-50
SD-51
SD-54
SD-55
SD-56
SD-59
SD-60
SD-61
100
0
200
FEET

FIGURE 7

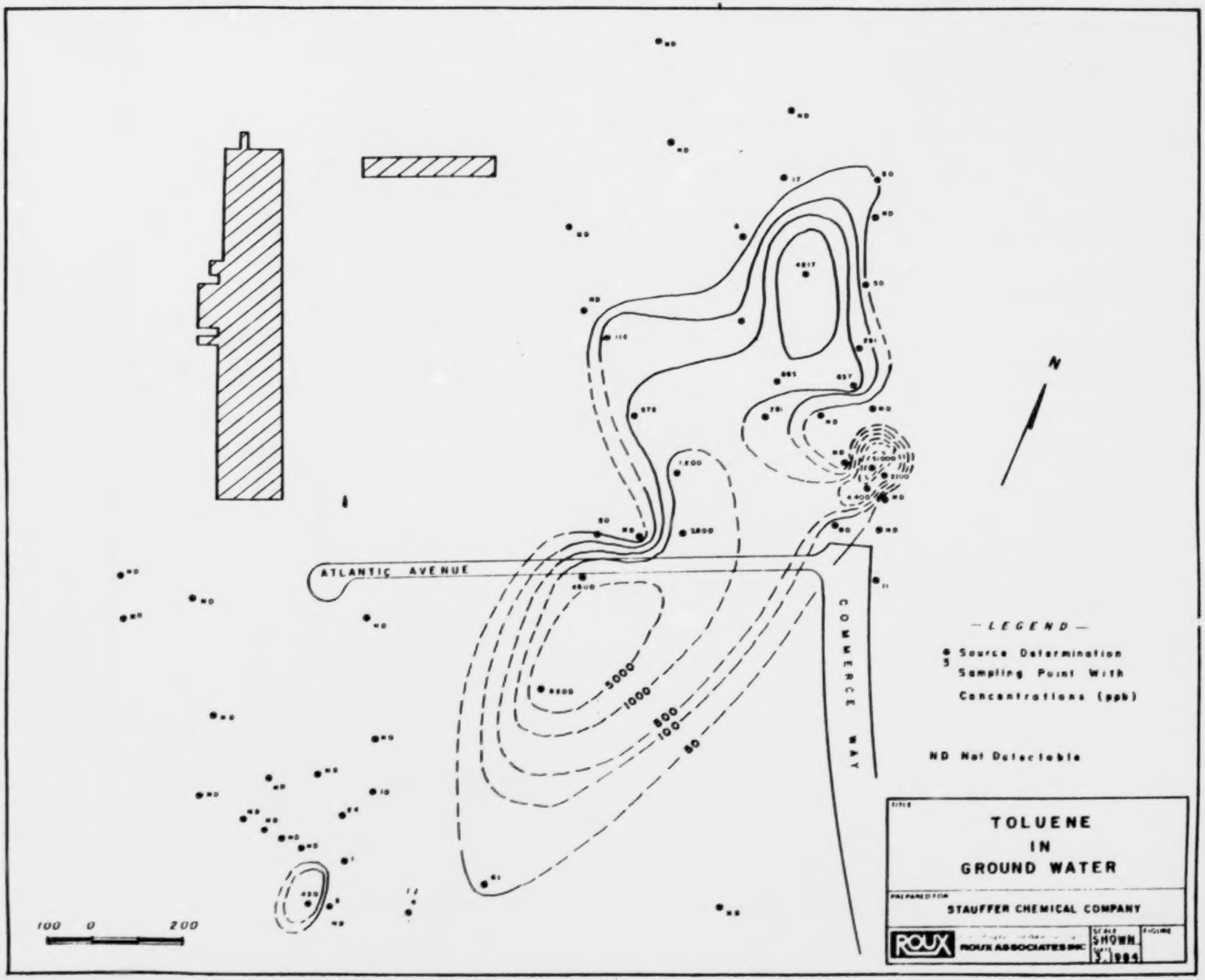

N
ATLANTIC AVENUE
COMMERCE WAY
4817
17
50
ND
291
657
885
278
116
1200
3800
51,000
2100
4400
8500
5000
1000
500
100
50
11
61
10
100 0 200
— LEGEND —
● Source Determination
5 Sampling Point With
Concentrations (ppb)
ND Not Detectable
TITLE
TOLUENE
IN
GROUND WATER
PREPARED FOR
STAUFFER CHEMICAL COMPANY
ROUX
ROUX ASSOCIATES INC
SCALE
SHOWN
DATE
3. 1984
FIGURE

FIGURE 8

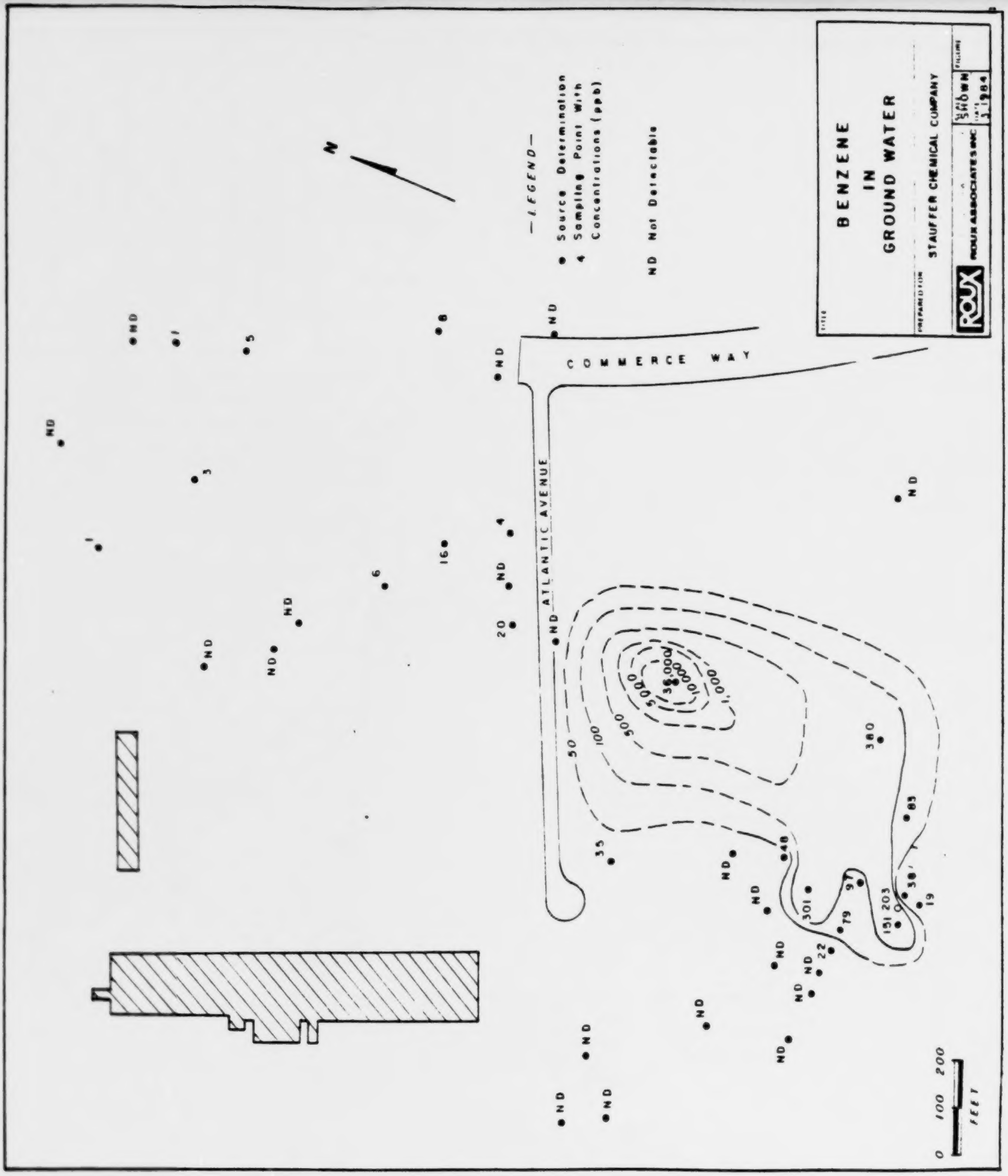

BENZENE
IN
GROUND WATER
PREPARED FOR
STAUFFER CHEMICAL COMPANY
ROUX
ROUX ASSOCIATES INC
SCALE SHOWN
DATE 1.1984
TITLE
FIGURE
—LEGEND—
● Source Determination
4 Sampling Point With Concentrations (ppb)
ND Not Detectable
N
COMMERCE WAY
ATLANTIC AVENUE
0 100 200
FEET
38,000
10,000
5,000
1,000
500
100
50
380
85
48
35
301
97
58
203
151
19
79
22
20
16
8
6
5
4
3
1
ND

FIGURE 9

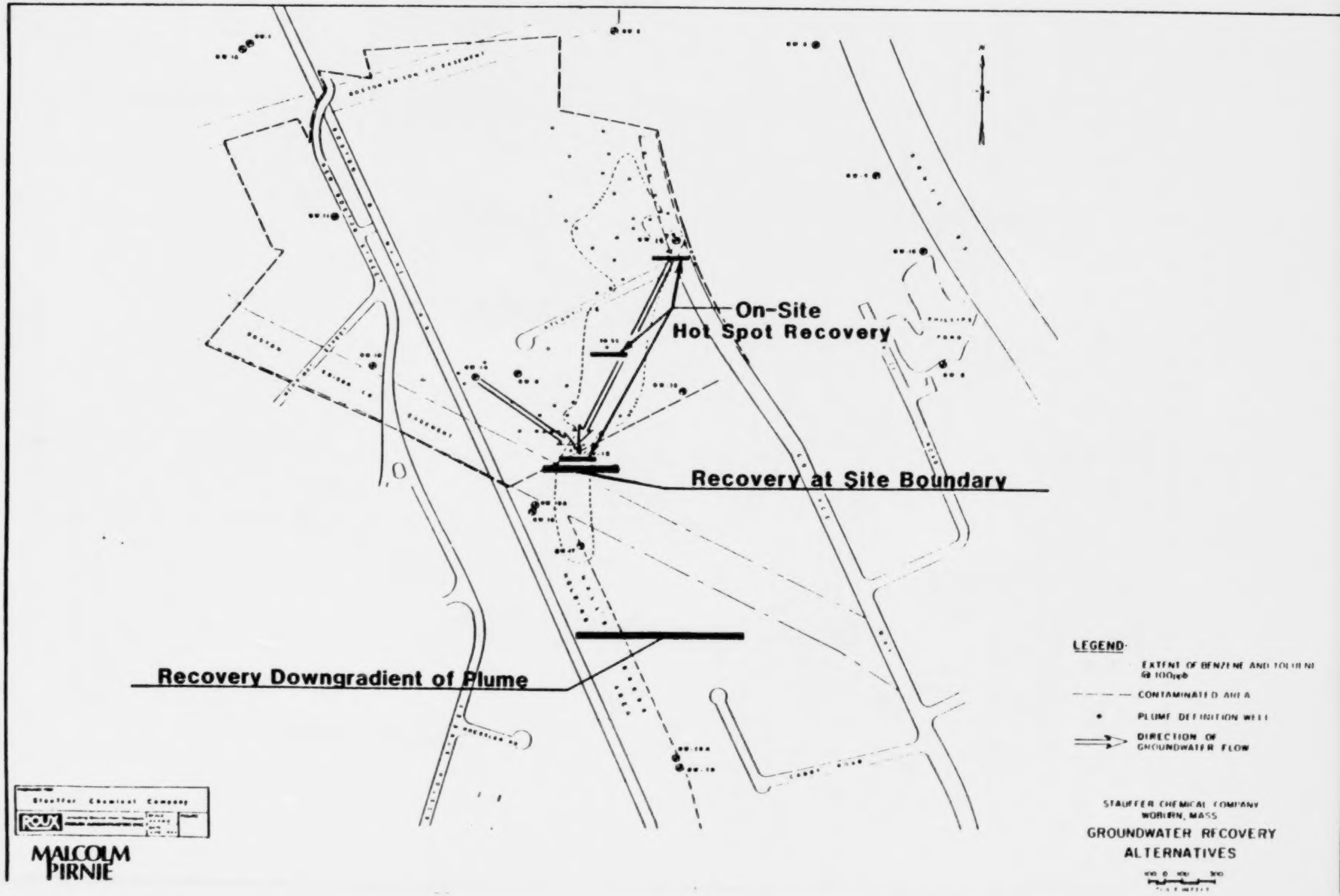
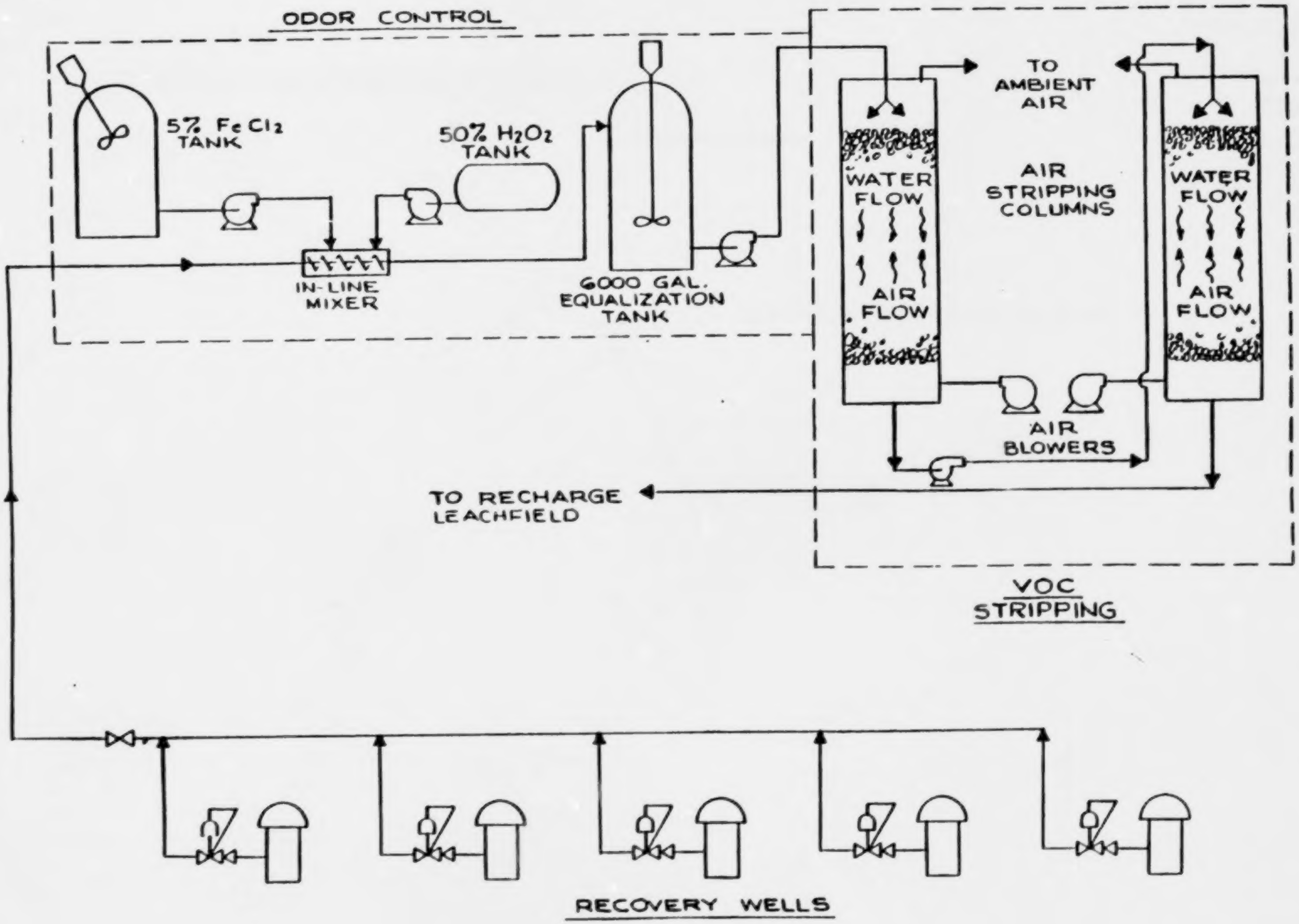
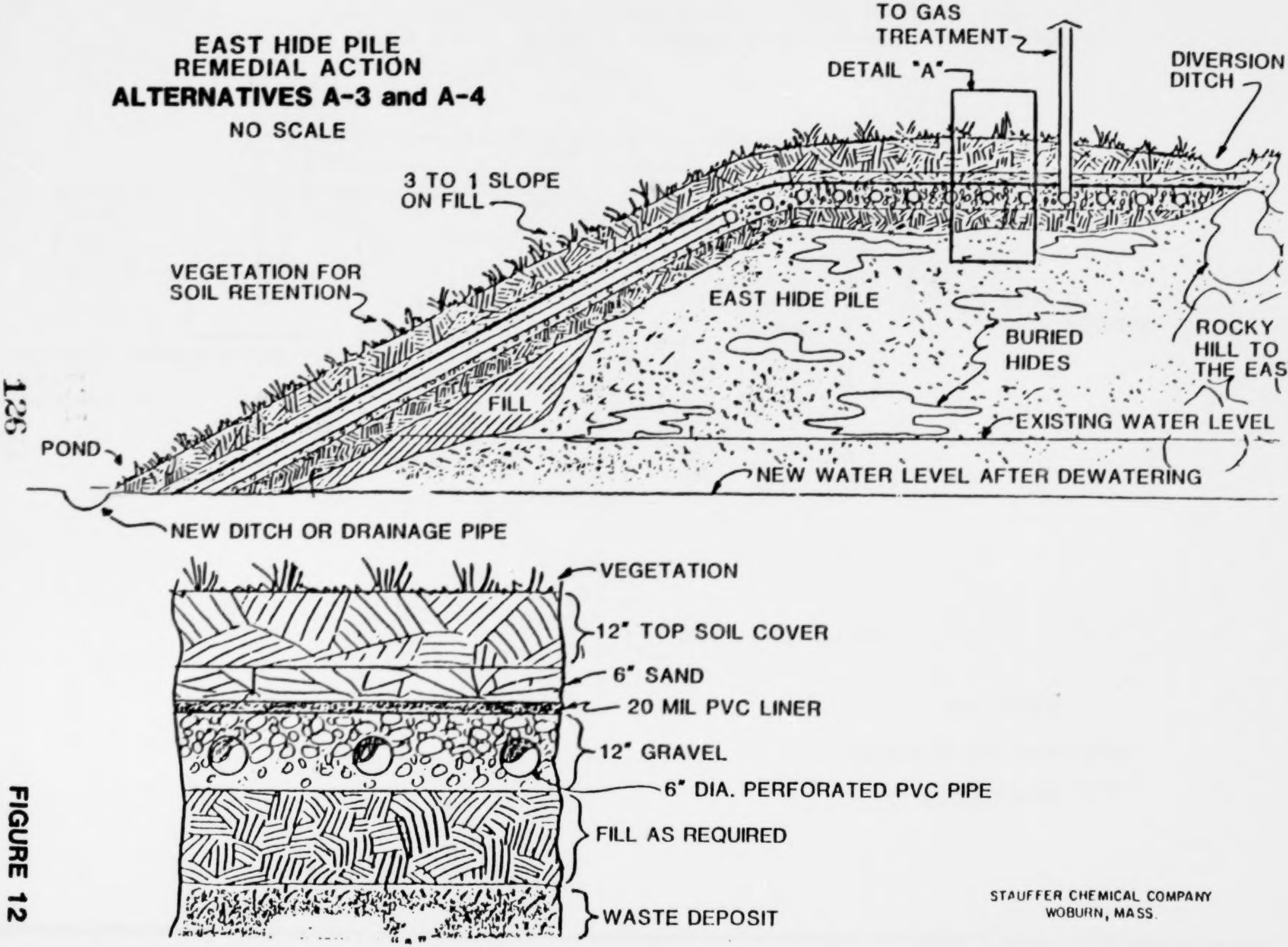

On-Site
Hot Spot Recovery
Recovery at Site Boundary
Recovery Downgradient of Plume
LEGEND:
EXTENT OF BENZENE AND TOLUENE @ 100ppb
CONTAMINATED AREA
PLUME DEFINITION WELL
DIRECTION OF GROUNDWATER FLOW
STAUFFER CHEMICAL COMPANY
WOBURN, MASS
GROUNDWATER RECOVERY
ALTERNATIVES
Stauffer Chemical Company
ROUX
MALCOLM PIRNIE

FIGURE 10



STAUFFER CHEMICAL COMPANY
WOBURN, MASS.
GROUND WATER TREATMENT
FLOW SCHEMATIC FOR **ALTERNATIVE GW-2**
(HOT SPOT RECOVERY)

FIGURE 11



EAST HIDE PILE
REMEDIAL ACTION
ALTERNATIVES A-3 and A-4
NO SCALE

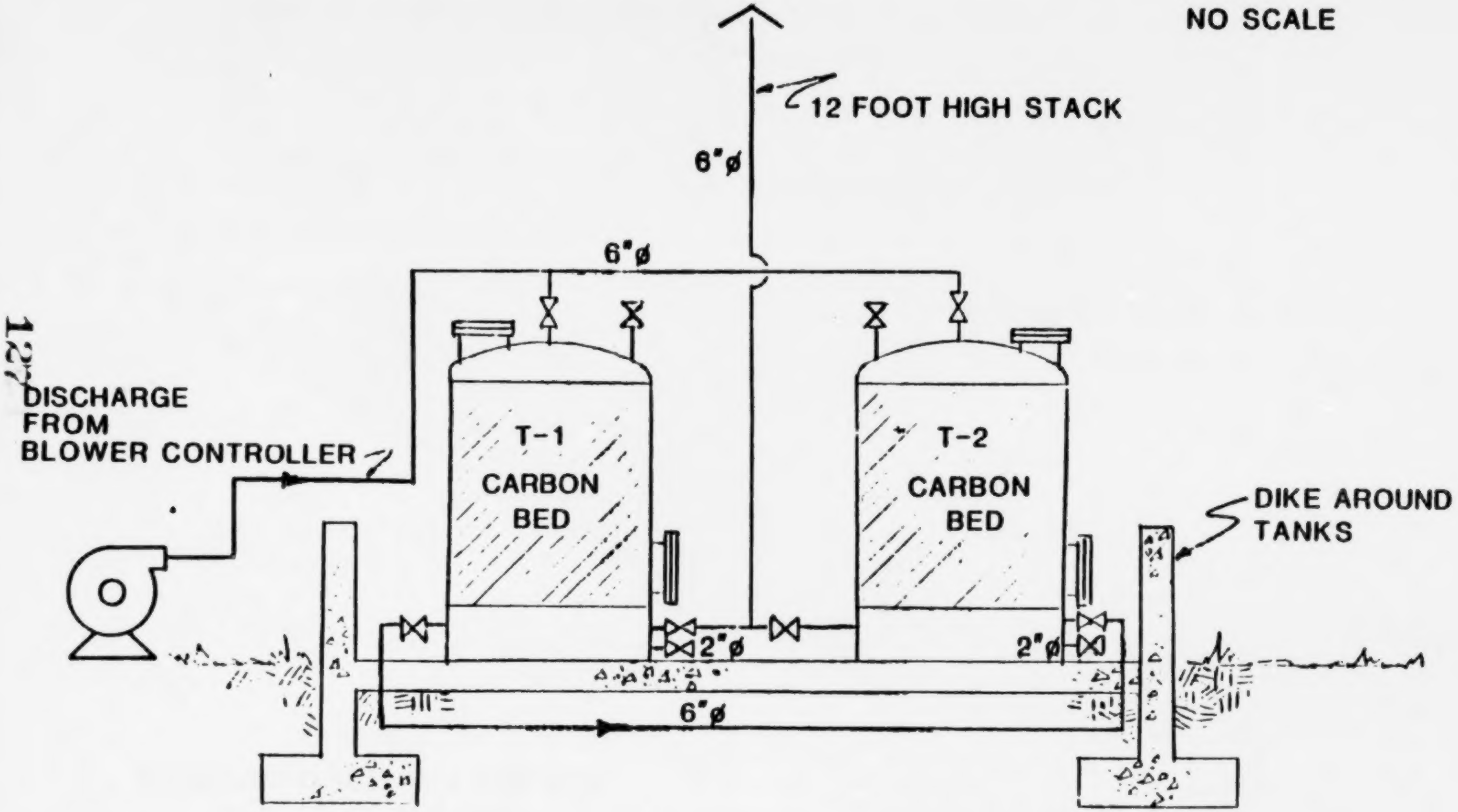
STAUFFER CHEMICAL COMPANY
WOBURN, MASS.

FIGURE 12

ALTERNATIVE A-3

(CARBON ADSORPTION)

NO SCALE



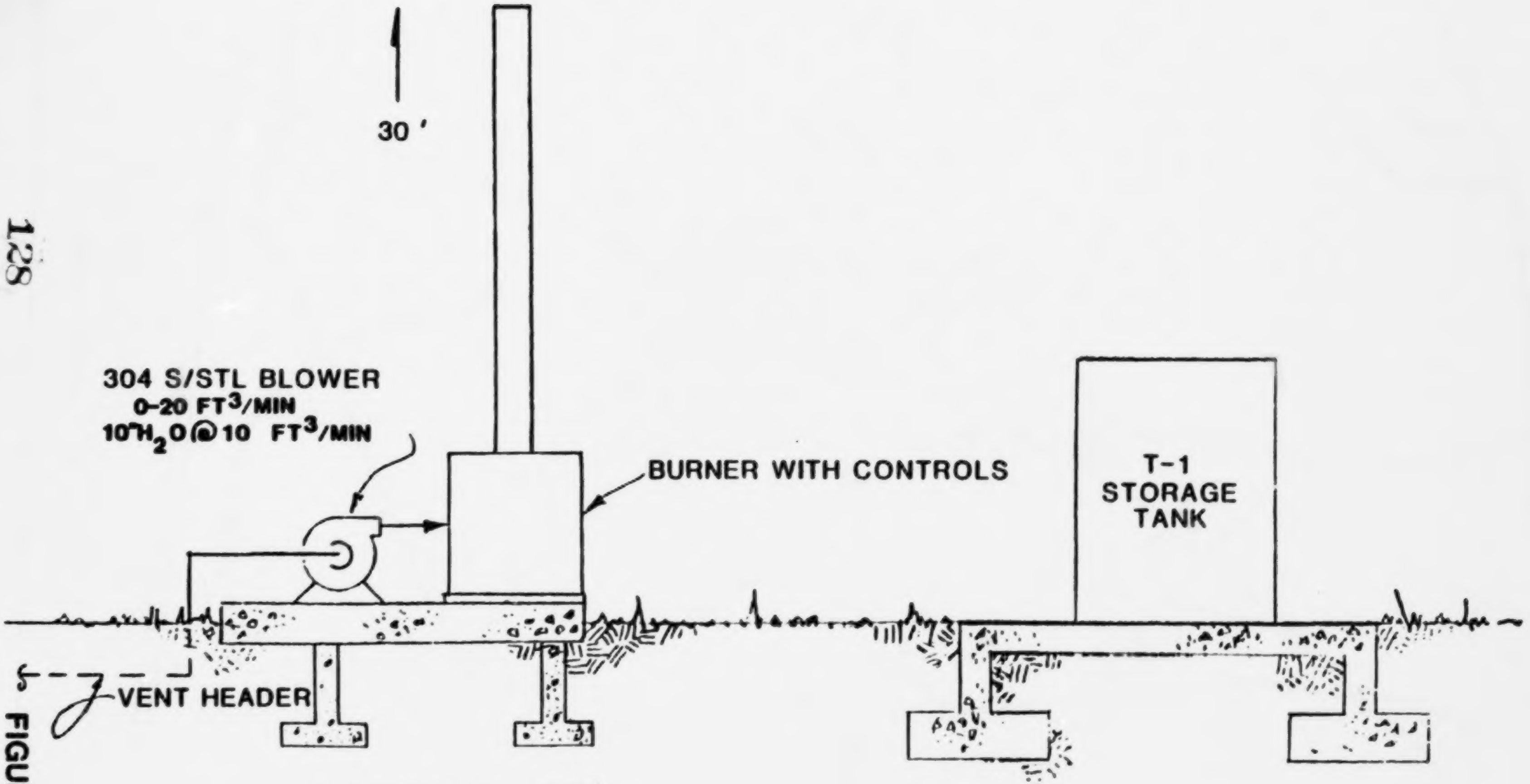
T-1 & T-2 8' DIA. x 6' HIGH 316 S/STL. WITH TOP MANHOLE, SIDE MANHOLE, FLUSH BOTTOM DRAIN, WITH INTERNAL SCREEN TO SUPPORT 6000 LBS. CALGON TYPE IVP CARBON BED

STAUFFER CHEMICAL COMPANY
WOBURN, MASS.

FIGURE 13

ALTERNATIVE A-4

(THERMAL OXIDATION)
NO SCALE



T-1 3000 GAL. C/STL
PROPANE STORAGE TANK

STAUFFER CHEMICAL COMPANY
WOBURN, MASS.

FIGURE 14

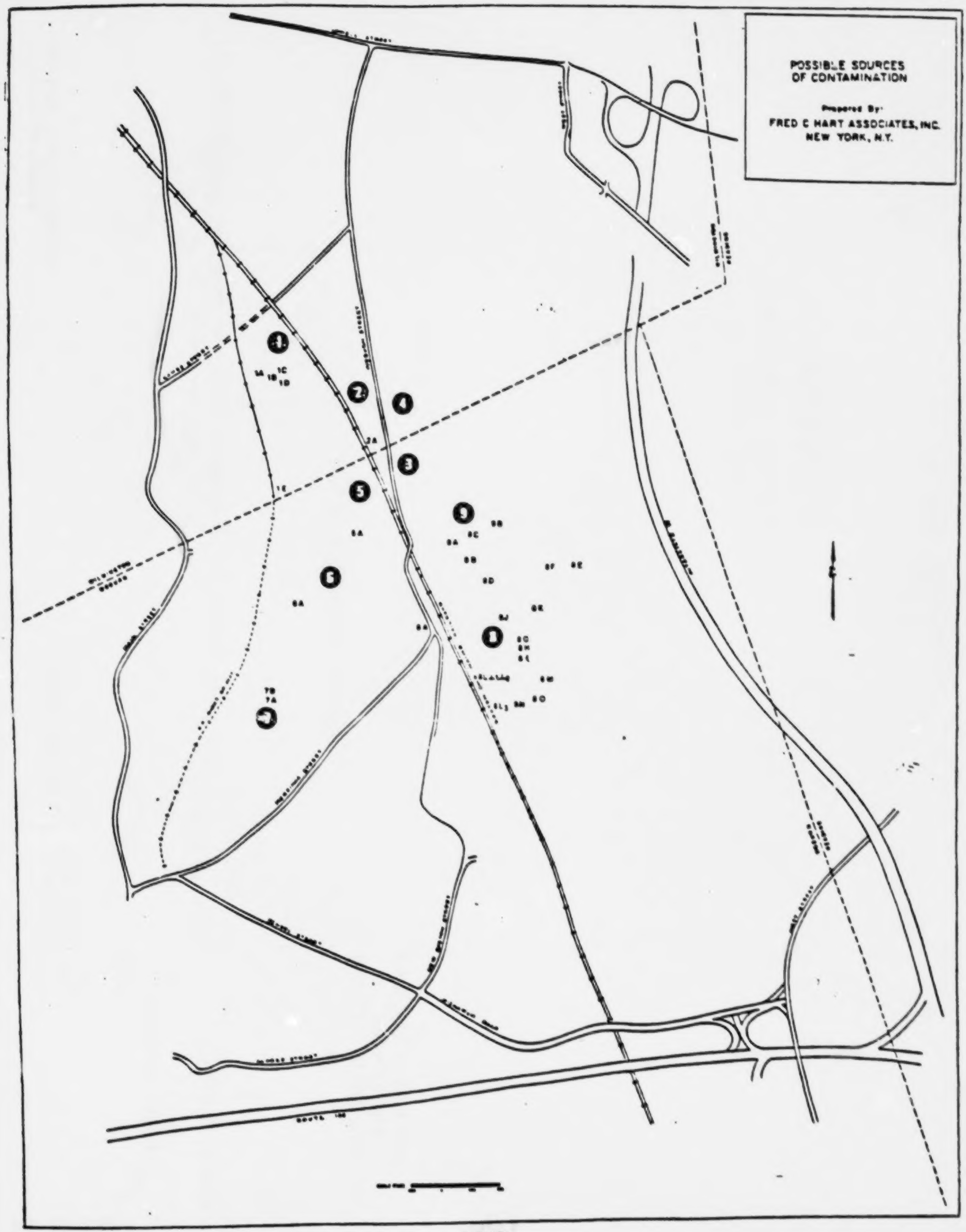

POSSIBLE SOURCES
OF CONTAMINATION
Prepared By:
FRED C HART ASSOCIATES, INC.
NEW YORK, N.Y.
1
1A
1B
1C
1D
1E
2
2A
3
4
5
5A
6
6A
7
7A
7B
8
9
9A
9B
9C
9D
9E
9F

FIGURE 15

POSSIBLE SOURCES IN AREA OF STUDY

Sources for this information are included in the notes following this table

Map Code	Location	Description	Suspected Wastes	Source* of Information	Potential Conduit (a)
1	Stepan Chemical	Chemical Mfg.	Formaldehyde, Hexamine	1	G,S,A
1-A	Stepan Chemical	Lagoon A	Acid Wastes	1,2,3	G,S
1-B	Stepan Chemical	Lagoon B	Acid Wastes	1,2,3	G,S
1-C	Stepan Chemical	Lagoon C	Acid Wastes	1,2,3	G,S
1-D	Stepan Chemical	Lagoon D	Acid Wastes	1,2,3	G,S
1-E	Stepan Chemical	Sludge Dump	Unknown	3	G,S
2	Whitney Barrel Co.	Drum Reclaiming	Unknown	2,3	G,S,A
2-A	South of Whitney Barrel				
3	Lipton Pet Food	Sediments	Unknown	2,3,4	G,S,A
4	Ritter Trucking Co.	Tank Trucks			G,S,A
5	Merrimac Chemical Co. (now New England Chemical Resins)	Factory	Leaking Barrels (contents unknown)	2,3	G,S,A
5-A	Merrimac Chemical Co.	Pond	Chromium, Arsenic, Zinc, Lead	2,3	G,S
6	Woburn Town Landfill				G,S
6-A	Woburn Town Landfill	Leachate Pond		2,3	G,S

* See notes following Table.

FIGURE 15 cont'd

Map Code	Location	Description	Suspected Wastes	Source of Information	Potential Conduit (a)
7	Industrial Area	Factory Building		2,3	
7-A		Impoundment A		2,3	
7-B		Site B		2,3	
8	Consolidated and Stouffer Chemical	Glue-Making Factory	Chromium and Other Heavy Metal Wastes		
8-A		Lagoon A	Unknown	2,3	G,S
8-B		Deposit B	(sampled)	2,3	G,S
8-C		Pond C	Unknown	2,3	G,S
8-D		Arsenic Lagoon D	Arsenic, Zirconium, Lead and Other Heavy Metals	2,3,4	G,S,A
8-E		Crescent Deposit E	Arsenic, Zinc		
8-F		Deposit F	Arsenic	2,3	G,S
8-G		Hill G[b]	Tannery Wastes (?)	2,3	
8-H		Pit H	Unknown	2,3	G,S
8-I		Pit I	Unknown	2,3	G,S
8-J		Dragline Excavation J	Tannery Wastes (Arsenic, Lead and Other Heavy Metals)	2,3	G,S
8-K		Tanks K	Unknown	2,3	
8-L		Hide Treatment Area		2,3	G,S

FIGURE 15 cont'

Map Code	Location	Description	Suspected Wastes	Source of Information	Potential conduit (a
$8\text{-}L_1$		Lagoon L_1	Tin, Lead, Antimony, Chromium	2,3,4	G,S
$8\text{-}L_2$		Lagoon L_2	Tin, Lead, Antimony, Chromium	2,3,4	G,S
$8\text{-}L_3$		Lagoon L_3	Tin, Lead, Antimony, Chromium	2,3,4	G,S
8-M		Hill M (sludge dewatering)	See Note c	2,3	
8-N		Pool N	Tin, Lead, Antimony, Chromium	2,3,4	
8-O		Deposit O	White Material (sampled)	2,3	
9-A	"Hide Pile"	Hide Pile #1	Chromium, Zinc, Lead	2,3,4	
9-B	"Hide Pile"	Hide Pile #2	Chromium, Zinc, Lead	2,3,4	

NOTES:

a. G, groundwater; S, surface water; A, air

b. Since the hill was mined for sand and gravel, the area may no longer be a source of contamination.

c. The one remaining hill behind Ohm's Mayflower Building, composed of materials of various colors has been sampled, (see Reference 3).

FIGURE 15 cont'c

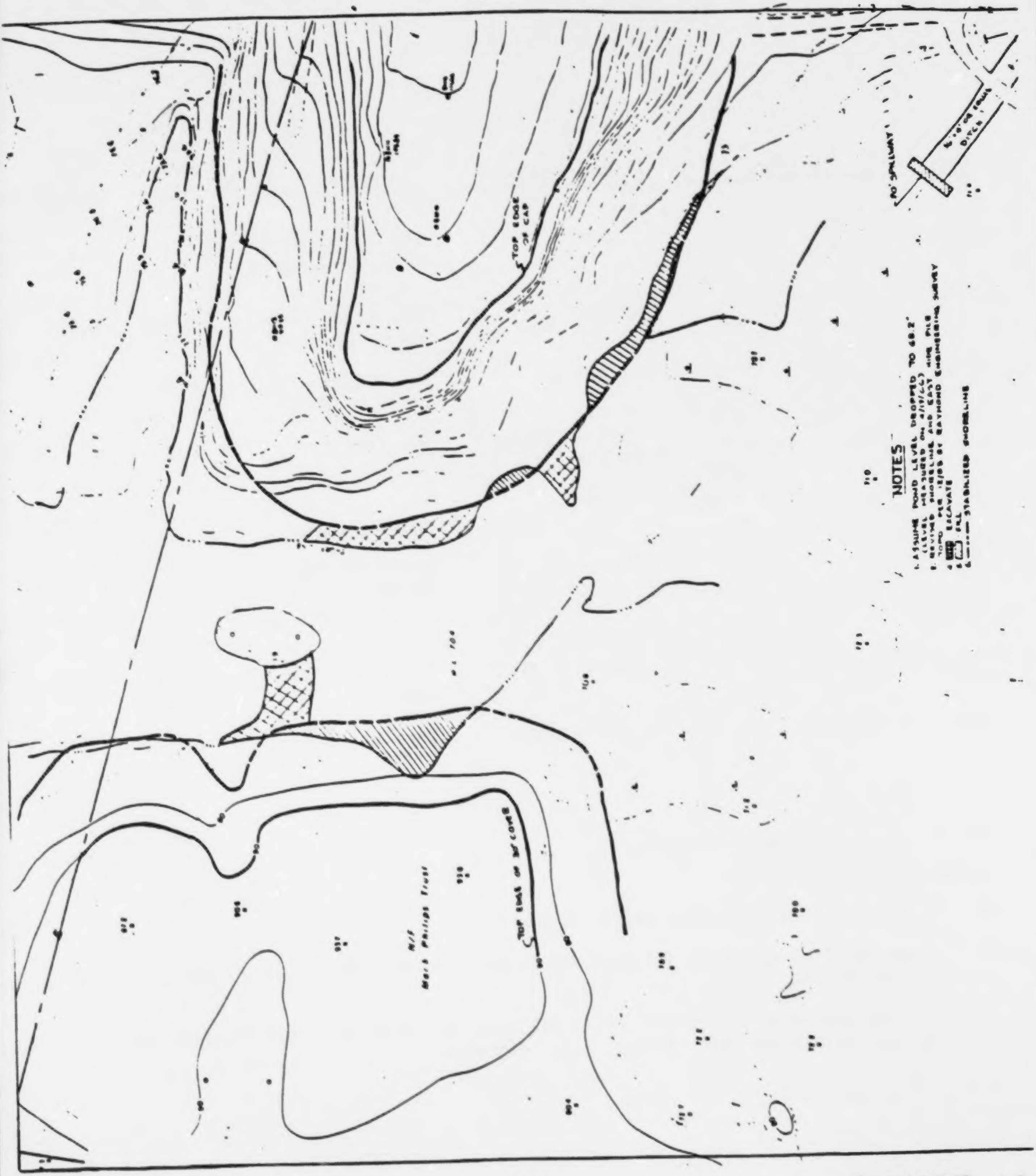
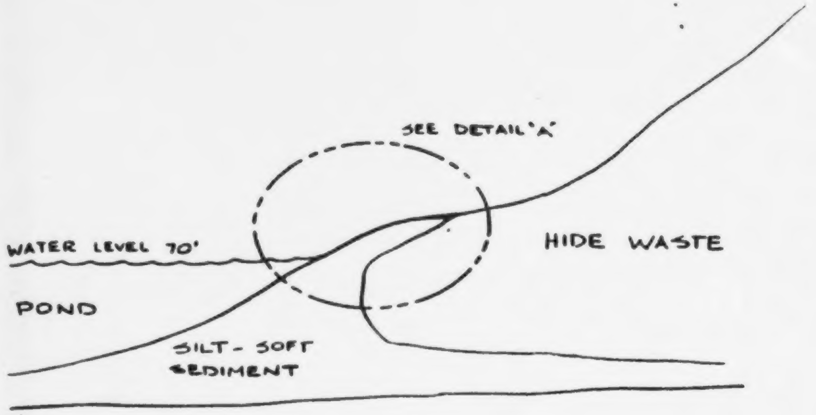
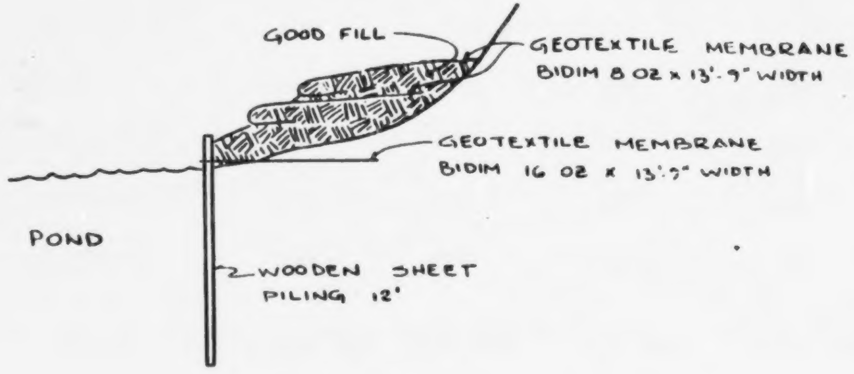

NOTES
1. ASSUME POND LEVEL DROPPED TO 68.2'
(LEVEL MEASURED ON 4/11/...)
4. EXCAVATE
5. FILL
6. STABILIZED SHORELINE
TOP EDGE OF CAP
10' SPILLWAY
DITCH
N/F
Mark Phillips Trust

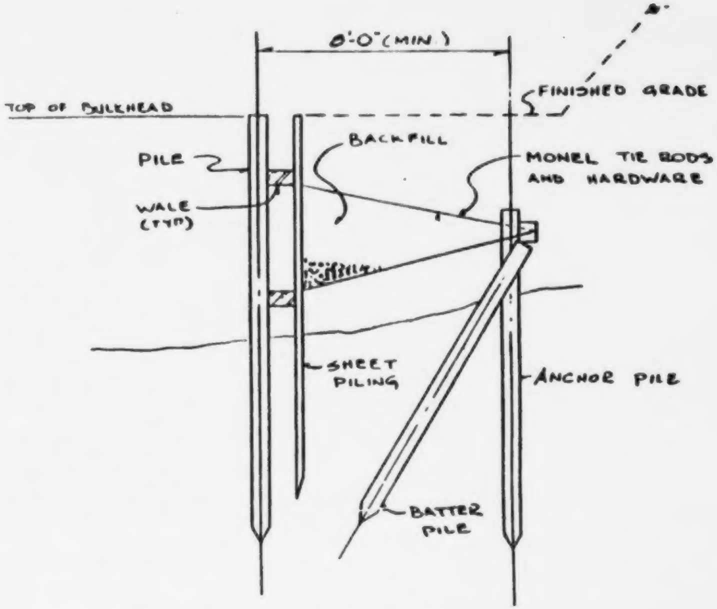
FIGURE 16




GOOD FILL
GEOTEXTILE MEMBRANE BIDIM 8 OZ x 13'-9" WIDTH
GEOTEXTILE MEMBRANE BIDIM 16 OZ x 13'-9" WIDTH
POND
WOODEN SHEET PILING 12'

DETAIL 'A'

TYPICAL WOODEN SHEET PILING



NOTE: THIS IS FOR ILLUSTRATIVE PURPOSES ONLY. IT IS NOT TO BE USED FOR DESIGN.

[illegible]

STAUFFER CHEMICAL CO. ENGINEERING DEPT. DOBBS FERRY, N			
SHORE STABILIZATION WOBURN MASS			
DWN BY L.H	CHK'D BY	APP'D BY	SCALE:
DATE 9-3-86	DATE	DATE	NONE
WORK ORDER NO	DWG NO		ISSU
WOBURN	021		

FIGURE 17

Summary of Phase II Soil Heavy Metal Analysis

Element	1065 Samples Analyzed 0-100 PPM	>100 PPM	>500 PPM	>1000 PPM	Distribution of Samples >100 PPM 25 Perc. Concent.	50 Perc. Concent.	75% Perc. Concent.	Maximum	Average
Arsenic	705	360	127	56	188	344	700	30800	809
Chromium	744	321	283	117	195	533	1890	80600	2300
Copper	625	440	202	106	198	418	940	23300	1042
Lead	517	548	346	249	330	819	2380	54400	2426
Mercury	1058	7	2	1	-	-	-	1900	-
Zinc	437	628	310	191	214	496	1350	126600	2072

TABLE 1

MONITOR WELL ANALYSIS

LOCATION	HEAVY METALS µg/l	pH	CONDUCTIVITY µmho/cm	CYANIDE µg/l	Cr^{+6} µg/l	TOTAL PHENOLS µg/l	ORGANIC COMPOUNDS µg/l
OW-1	Be-8	6.55	950	N.D	N.D	N.D.	BE39(napthalene)-63 BE13(bis(ethyl hexyl)phthalate)-125 BE29(di-N-octyl phthalate)-11 trichloropropene 144 trimethyl benzene 45 ethenyl methyl benzene 45 bromocyclo hexene-84 hexahydro Azepinone 114
OW-1A	Be-8 Zn-55	6.12	520	N.D.	N.D.	62	BE13-181 BE29-14 hexahydro Azepinone 60
OW-2	Zn-37	6.68	110	N.D.	N.D.	N.D.	VO22(methylene chloride)-33 BE13-15
OW-3	Zn-32	7.06	900	N.D.	N.D.	N.D.	VO22-31 BE13-17 hexahydro Azepinone 202
OW-4	Be-6 Zn-26	7.12	430	N.D.	N.D.	N.D.	BE13-112
OW-5	Zn-50	6.19	380	N.D.	N.D.	N.D.	VO22-134 BE13-50 BE39-15 trichloropropene 53 trimethyl hexene 100 Bromocyclo hexene 18 hexahydro Azepinone 17
OW-6	Zn-35	6.53	440	N.D.	N.D.	N.D.	VO22-126 BE39-14
OW-7	As-18 Zn-16	6.01	350	N.D.	N.D.	N.D.	VO22-16 BE39-20
OW-8	As-2 Zn-41	7.53	590	N.D.	N.D.	N.D.	VO22-11 BE13-876
OW-9	Cu-20 Zn-28	7.53	1250	N.D.	N.D.	73	BE39-20 BE13-697 BE29-18 trichloropropene-58 trimethyl hexene-80 hexahydro Azepinone 17

BE 39 (NAPHTHALENE)

TABLE 2

LOCATION	HEAVY METALS µg/l	pH	CONDUCTIVITY µmho/cm	CYANIDE µg/l	Cr^{+6} µg/l	TOTAL PHENOLS µg/l	ORGANIC COMPOUNDS µg/l
OW-10	As-2 Cu-840 Zn-5700	5.20	390	N.D.	N.D.	N.D.	VO22(methylene chloride)-10 BE13(Bis(ethylhexyl)phthalate)-42
OW-11	As-8 Zn-85	6.01	670	N.D.	N.D.	N.D.	VO22-28 BE13-21
OW-12	Ag-10 As-26 Ba-230 Cr-120 Cu-40 Ni-80 Zn-58 Be-5	7.63	>7500	94	N.D.	390	methylene chloride-19 VO3(Benzene) 491 VO25(Toluene) 1100 AE10(phenol)-236 BE39(napthalene)-68 BE13(phthalate)-1090 methyl phenol-689 cyclo heptatriene-1970 [1,1-biphenyl]-3-ol-90 Sulfonyl bis benzene - 984 [1,1 biphenyl] -2,2-diol 54
OW-13	As-7 Pb-120 Zn-8 Be-7	7.52	1400	N.D.	N.D.	N.D.	dichlorotrifluoro ethane-190 BE13-2370 BE29(Di-N-Octyl phthalate)9-23 sulfonyl bis benzene 81
OW-14	As-9 Zn-540 Be-8	6.13	1600	N.D.	N.D.	N.D.	Toluene 114 BE13-1240 BE39-74 BE29-42 trichloropropene-72 trimethyl benzene-21 ethenyl methyl benzene 17 bromocyclo hexane 38 sulfonyl bis benzene 17
OW-15	Zn-31 Ba-8	6.50	510	N.D.	N.D.	N.D.	BE13-108
OW-16	As-5 Ba-200 Cr-100 Ni-60 Zn-143 BE-6	7.44	>7500	70	N.D.	1900	Acetone-2110 MEK 276 4-methyl pentanone-242 toluene-950 BE39-132 AE10-95 BE13-204 BE29-155 benzaldehyde-64 cyclo heptatriene 2540 methyl butanoic acid 512 methyl phenol 888

TABLE 2 cont'd

LOCATION	HEAVY METALS µg/l	pH	CONDUCTIVITY µmho/cm	CYANIDE µg/l	Cr^{+6} µg/l	TOTAL PHENOLS µg/l	ORGANIC COMPOUNDS µg/l
OW-17	As-16 Ni-60 Pb-70 Sb-16 Zn-112 Be-9	6.90	>7500	37	N.D.	7840	Benzene-747 Tetrachloro ethane-16 Toluene 177 AE10-453 BE13-341 BE29-126 BE39-83 bromo cyclohexene 35 [1,1-biphenyl] 2-01 97 unknown 119 sulfonyl bis benzene 227 [1,1-biphenyl]-3-01 127
OW-18	Cu-150 Zn-6090 Be-7	5.58	950	N.D.	N.D.	N.D.	VO26(Trans-1, 2-dichloroethylene)-10 VO29(trichloroethylene)-16 BE15(Butyl Benzyl phthalate)-73 BE13-2200 BE29-180 phthalates-61 trimethyl tridecatriene nitrile-163
OW-18a	Cu-80 Zn-126 Be-7	6.43	1000	N.D.	N.D.		BE13-352
OW-19	As-7 Zn-47,000	6.19	540	N.D.	N.D.	N.D.	N.D.
OW-19a	As-31 Zn-36	6.36	480	N.D.	N.D.	N.D.	Hexahydroazepinone - 26 Unknown extractible 14 " " 16 " " 46 " " 16 " " 17 " " 14 " " 36 " " 22
OW-20	As-14 Zn-20	8.42	640	N.D.	N.D.	N.D.	
OW-20a	As-106 Zn-24	6.12	900	N.D.	N.D.	N.D.	

TABLE 2 cont'd

Monitor Wells with Elevated VOC Analysis

	8/82		8/16/83 or 8/30/83		9/29/83	
CATION	PRIORITY POLLUTANT - µg/l	OTHER COMPOUNDS - µg/l	PRIORITY POLLUTANT - µg/l	OTHER COMPOUNDS - µg/l	VOC PRIORITY POLLUTANTS - µg/l	OTHER VOC COMPOUNDS- µg/l
OW-12	BE39-15	Methyl Butanoic acid 121 Benzoldehyde 22 Dihydrotetrazine 102 Benzene Acetic Acid 1850 Bis Sulfonyl Benzene 651	Benzene 491 toluene 1100 BE13 1090 BE39 68	bis sulfonyl benzene 989 cycloheptatriene- 1970	Benzene 203 toluene 355	Acetone 71
OW-14	0	0	Toluene 114	Trichloropropene 72 Trimethyl benzene 21 Ethenyl methyl benzene 17 Bromocyclohexane 38	Toluene 13	phthalates- 42
OW-16	Not installed		Toluene 950	Bis sulfonyl benzene 37 Acetone 2110 MEK 276 4-methyl pentanone 242	*Toluene 32600/31900	*Acetone 1410/1450 *2-propanol 49/40 *MEK 236/231 *3-methyl furan 14/28 *4-methyl pentanone 48/70
OW-17	Not installed		Benzene 747 Toluene 177 Tetrachloroethane 16		Benzene 402 Toluene 204	0

*duplicate sample

TABLE 3

EP Toxicity Tests of Soil Composites

Composite	Sample Location	Sample Depth-Ft	Heavy Metal	Heavy Metal Concentration Soil Composite PPM (µg/g)	EP Extract PPB (µg/l)	Percent of Soil Metal Extracted
#1	29450	1	As	169	N.D.	N.D.
	29450	3	Cr(total)	229	11	0.1%
	29450	5	Cr^{+6}	Not Analyzed	N.D.	N.D.
	30360	1	Cu	200	50	0.5%
			Hg	1.8	N.D.	N.D.
			Pb	738	110	0.3%
			Zn	314	1630	10.4%
#2	30360	5	As	306	N.D.	N.D.
	30360	7	Cr(total)	798	N.D.	N.D.
	39210	1	Cr^{+6}	Not Analyzed	N.D.	N.D.
	39210	3	Cu	298	29	0.2%
			Hg	2.1	N.D.	N.D.
			Pb	991	N.D.	N.D.
			Zn	462	363	1.6%
#3	39210	5	As	621	N.D.	N.D.
	42360	1	Cr(total)	119	N.D.	N.D.
	42360	3	Cr^{+6}	Not Analyzed	N.D.	N.D.
	42360	5	Cu	881	226	0.5%
			Hg	1.7	N.D.	N.D.
			Pb	1943	20	0.02
			Zn	729	2920	8%
#4	43330	1	As	43	N.D.	N.D.
	52300	1	Cr(total)	943	11	0.02%
	52300	11	Cr^{+6}	Not Analyzed	N.D.	N.D.
	52300	26	Cu	101	N.D.	N.D.
			Hg	0.5	N.D.	N.D.
			Pb	533	N.D.	N.D.
			Zn	208	581	5.6%

N.D. - Indicates less than instrumental detection levels

As	<30 PPB
Cr(total)	<3 PPB
Cr^{+6}	<14 PPB
Cu	<2 PPB
Hg	<0.5 PPB
Pb	<20 PPB
Zn	<1 PPB

TABLE 4

Borehole Gas Emission Rates

(Volume of Collection Bag = 4.2 Cubic Feet)

Bore Hole	Test	Meter Readings Combustible Gas - %	 H_2S PPM	Time to Fill Bag minutes	Generation Rate (cfm)	
9	1	34	>250	18:00	0.23	
	2	52	>250	16:45	0.25	
	3	42	>250	13:00	0.32	Avg. 0.27
10	1	40	>250	2:55	1.44	
	2	46	>250	3:45	1.12	
	3	44	>250	3:30	1.20	Avg. 1.25
11	1	44	>250	21:30	0.20	
	2	52	>250	26:30	0.16	
	3	47	>250	22:15	0.19	Avg. 0.18
12	1	30	>250	48	0.091	
	2	24	>250	41	0.110	Avg. 0.101
13	1	24	>250	182	0.023	
	2	28	>250	210	0.021	Avg. 0.022
20	1	46	0/115	1114	0.0038	
21	1	56	0	6:35	0.64	
	2	52	0	7:50	0.54	
	3	48	0	5:35	0.76	Avg. 0.65

TABLE 5

Borehole Air Analysis

Bore Hole	Location	Compound	Conc. (PPM)
BH 9	52451	hydrogen sulfide	5700/5530 (1)
		2-propanethiol	180
		methanethiol	64
		2-butanethiol isomer	3.4
		ethanethiol	3.1
		methyl furan isomer	1.3
		trichlorofluoromethane	0.59
BH 10	51411	hydrogen sulfide	1.8%/2.1% (1)
		methanethiol	50
		2-propanethiol	42
		ethanethiol	8
		carbon oxide sulfide	6.3
		benzene	1.1
BH 11	52431	hydrogen sulfide	5800/5600 (1)
		2-propanethiol	42
		methanethiol	20
		ethanethiol	6.5
		carbon oxide sulfide	5.4
		2-butanethiol isomer	2.2
BH 12	52381	hydrogen sulfide	1.9%/1.9% (1)
		methanethiol	150
		2-propanethiol	55
		ethanethiol	17
		carbon oxide sulfide	13
		benzene	11
		carbon disulfide	11
		dimethyl disulfide	7.5
		methyl furan isomer	1.4
		2-butanethiol isomer	1.1
		toluene	1.1
BH 13	53423	hydrogen sulfide	2.0%/2.1% (1)
		2-propanethiol	180
		methanethiol	110
		ethanethiol	19
		carbon oxide sulfide	12
		dimethyl disulfide	7.8
		2-butanethiol isomer	5.5
		carbon disulfide	3.3
		benzene	1.5
		trichlorofluoromethane	0.63

(1) duplicate analyses, same sample

TABLE 6

Bore Hole	Location	Compound	Conc. (PPM)
BH 14	36532	hydrogen sulfide	2000/1900 (1)
		2-propanethiol	9
		methanethiol	2.4
BH 16	37521	hydrogen sulfide	51/43 (1)
		2-propanol	20
		2-propanethiol	6.6
		methanethiol	4.3
		carbon oxide sulfide	4.1
		ethanethiol	4
		dimethyl disulfide	1.1
BH 17	39551	2-propanethiol	11
		methyl furan isomer	2.8
		ethanethiol	2
BH 19	51301	hydrogen sulfide	200/200 (1)
		2-propanethiol	17
		benzene	2.3
		toluene	1.6
		trichlorofluoromethane	1.6
BH 20	52301	hydrogen sulfide	710/690 (1)
		toluene	0.73
BH 21	51291	hydrogen sulfide	58/50 (1)
		benzene	1.2
		toluene	0.76
BH 22	40601	(nothing detected)	
BH 23	29412	hydrogen sulfide	5300/4600 (1)
		2-propanethiol	47
		methanethiol	18
		toluene	3.9
		ethanethiol	2.5
		bis(2-methylpropyl)disulfide	1.9
BH 24	44521	(nothing detected)	
BH 25	43571	hydrogen sulfide	240/250 (1)
		methanethiol	220
		ethanethiol	77
		dimethyl disulfide	1.6

(1) duplicate analyses, same sample

TABLE 6 cont'd

DIRECT SENSORY EVALUATION OF BORE HOLE GASES

Bore Hole No.	Dilutions to Threshold(1)	Dose/Response Analysis(2)				Odor Characteristics
		-A Slope	B Int.	r Regr. Coef.	Dilutions to TIA = 1	
9	64,000	1.23	6.12	0.970	14,000	H_2S, X-SH, sour, fatty acid, fecal, oniony-SH, solventy
10	>1 x 10^6	1.40	8.87	0.973	430,000	H_2S
11	256,000	1.12	6.29	0.994	50,000	H_2S, rubbery, sulfide, oniony
12	512,000	1.66	9.89	0.993	230,000	H_2S
13	512,000	1.21	6.99	0.947	86,000	H_2S
14	128,000	1.37	7.30	0.994	40,000	H_2S, trace fecal, trace sour
16	128,000	0.83	4.49	0.974	15,000	Cheesey sour, dirty sour, burnt sweet, trace fecal (butyric, propionic, and isovaleric acids)
17	8,192	0.73	3.35	0.989	2,000	Animal, sweet fragrance, fecal, DMS, musty, sulfidy (WWTP)
19	4,096	1.16	4.55	0.987	1,400	Sulfidy, sour, oniony-SH, tarry, fecal
20	32,000	0.97	4.53	0.994	4,200	Sour, oniony, SH, vegetable sulfide, rubbery, slightly fecal and H_2S, naphthalene (moth balls)
21	4,096	1.04	4.22	0.993	1,200	Oniony, sulfidy, animal, horsey, rubbery, tarry, fecal

DIRECT SENSORY EVALUATION OF BORE HOLE GASES

		Dose/Response Analysis(2)				
Bore Hole No.	Dilutions to Threshold(1)	-A Slope	B Int.	r Regr. Coef.	Dilutions to TIA = 1	Odor Characteristics
22	2,048	1.07	3.73	0.992	350	Horsey, animal, fecal, leathery, sulfide, oniony
23	512,000	0.99	6.06	0.946	135,000	H_2S, trace oniony, oniony-SH, rubbery, animal, fecal
24	2,048	0.83	2.93	0.967	200	Fecal, rubbery sulfide, vegetable sulfide, animal, musty, WWTP
25	512,000	0.99	5.71	0.982	55,000	Fermented sour, cheesey, garbagey

(1) Recognized by 100% of the panel participants.

(2) Results of best fit for all data, TIA = A (log Dilutions) + B.

TABLE 7 cont'd

SENSORY EVALUATIONS OF

ADSORBED BORE HOLE ODORS

Bore Hole No.	Odor Characteristics	
	Air Eluted	Solvent Eluted
9	Oniony, sour, sulfidy, burnt oniony	Oniony (Pr or allyl-SH) fecal (skatole), solventy naphthalene)
10	Oniony, horsey, animal, fecal	(Me or ET)-SH, Pr-SH, fecal and fatty acid, rubbery
11	Oniony, fecal, rubbery, sulfide, DMS or DMDS	Oniony, (Pr or allyl-SH), fecal, p-dichlorobenzene
12	Oniony, horsey, DMS, animal	Oniony-SH, rubbery-SH (TBM), musty-earthy, horsey, trace skatole
13	Corny (DMS), barny, fecal, vegetable sulfide	-SH (TBM?), musty, animal, fecal, skatole
14	Fecal, burnt sweet, animal	Rubbery-SH or sulfide, musty-earthy, fecal (WWTP)
16	N/A	N/A
17	N/A	N/A
19	Oniony, garlicky, rubbery	-SH (Me or ET), tarry, oniony, WWTP
20	N/A	N/A
21	Trace acetic acid, sulfidy, horsey, animal	Sulfidy, fuel oil, WWTP
22	N/A	N/A
23	Oniony, sour, rubbery, animal, horsey, fecal	-SH, fuel oil WWTP, fecal
24	N/A	N/A
25	Putrid, cheesey, garbagey fermented sour, trace fecal, coffee-like-SH	Cheesey, burnt, animal, fecal (WWTP), benzene-tarry (trace methyl benzene)

TABLE 8

GROUND WATER REMEDIATION METHODS OMITTED FROM FURTHER EVALUATION

Ground Water Interception/Recovery

Remedial Method	Omission Rationale
1. Containment barriers, slurry walls or grout curtains with/without ground water pumping	Feasibility and Reliability, Environmental Effectiveness, Cost: A slurry wall/grout curtain around entire site is not feasible as a result of the integrity of the bedrock floor underlying the site. The bedrock to the east, west, and south is frequently fractured, permeable and dips steeply under the site. This will not be suitable as a floor for a slurry wall or grout curtain. A slurry wall would significantly heighten the water table at the site and ground water pumpage would be required anyway. Permeabilities of sediments underlying the site and adjacent to the buried valley are low, so many wells would be required. A slurry wall/grout curtain upgradient of the site to reduce inflow of ground water is not feasible because most ground water flowing in the unconsolidated deposits under the site originates as precipitation on the site. Very little flow into the site occurs from unconsolidated deposits upgradient of the site. This would, therefore, have no effect on the migration of the benzene plume.
2. Water table adjustment to minimize flow through waste material	Environmental Effectiveness: Ground water flowing through the unconsolidated deposits underlying the site originates as precipitation. Very little water enters the site through unconsolidated deposits upgradient, so upgradient pumpage would a have negligible effect on total flow rate.

TABLE 9

GROUND WATER REMEDIATION METHODS OMITTED FROM FURTHER EVALUATION

Ground Water Treatment

Remedial Method	Omission Rationale
1. Treat recovered ground water with ion exchange resins	Feasibility and Reliability, Environmental Effectiveness, Cost: Treatment via ion exchange requires pretreatment to remove solids, competitive ions and other resin fouling agents. Additionally, multiple exchange resins would be required to remove potential range of ions identified in soils and ground water. Pretreatment requirements, number and life expectancy of resin columns increases capital cost significantly above other alternatives without equivalent increase in environmental effectiveness.
2. Treat recovered ground water with reverse osmosis	Feasibility and Reliability, Environmental Effectiveness: Reverse osmosis has extremely stringent pretreatment requirements to avoid immediate failing. The pretreatment steps will improve water quality to acceptable levels (with the exception of arsenic removal) without incorporation of reverse osmosis or the costs inherent in the process. Therefore, increased cost with no significant increase in environmental effectiveness renders this process unnecessary for attaining required low effluent concentrations.
3. Treat recovered ground water with PAC	Environmental Effectiveness, Cost: PAC offers no advantage over GAC for treatment efficiency in Woburn-type application. Filtration required prior to discharge and disposal of spent PAC after filtration increase O&M requirements and cost far in excess of GAC with no practical environmental benefits.
4. Permeable treatment bed for VOC, solids removal	Feasibility, Reliability, Environmental Effectiveness: Effectiveness of this technology is not well developed due to short circuiting/ channeling and nondistributed contact.

TABLE 10

GROUND WATER REMEDIATION METHODS
OMITTED FROM FURTHER EVALUATION

Ground Water Discharge

Remedial Method	Omission Rationale
1. Treatment, discharge to MDC sewer	MDC cannot accept additional flow until court-ordered mandates are in place
2. Direct discharge to MDC sewer	Same as above.
3. Treatment, discharge to aquifer upgradient via trench, pond or leach field	Feasibility and Reliability: Technically feasible only for small volumes of water such as would be generated by hot spot pump out. Greater than 50-75 gpm would overload the shallow aquifer and cause surface flooding. This is particularly a problem in developed areas.
4. Treatment, discharge to aquifer downgradient via trench, pond or leach field	Same as above except a slightly greater (100 gpm) quantity might be accomodated. However, extensive development in the area north of Mishawam Road limits space for recharge facility. Flooding of adjacent developed area is likely.
5. Treatment, discharge to aquifer via well injection downgradient	Might accomodate up to 400 gpm and avoid flooding and land availability problems, but additional well costs and treatment (to avoid plugging) without any significant advantages.

TABLE 11

TABLE 12

FUNCTIONAL ANALYSIS MATRIX -- FUNCTIONAL AREA: GROUND WATER INTERCEPTION/RECOVERY

Evaluation Criteria	Weighting Factor	On-Site Hot Spot Recovery		Downgradient of Site Recovery of Ground Water		Downgradient of Plume Recovery of Ground Water	
		Rating	Comment	Rating	Comment	Rating	Comment
1. Reliability	1.1	4	Difficult to define hot spot	5	Would collect the majority of presently known concentrations of benzene	5	Would ensure that no benzene migrates downgradient
2. Constructibility	0.6	5	Easiest to install due to minimum number of wells installed at shallower depth	4	Fewer wells than full downgradient recovery	2	Up to 5 recovery wells to withdraw the entire plume
3. Implementation Time Frame	0.5	5	Pumping duration shorter due to relatively undiluted contaminant plume	3	May require as long as 11 years due to variable flowrates	2	Long period to set up, operate and complete recovery of migrating benzene
4. Environmental Effectiveness	2.0	3	Will reduce the potential risk to the downgradient receptor population	4	Will minimize the potential risk to the downgradient receptor population	5	Will nullify the potential risk to the downgradient receptor population
Total		15.9		17.4		18.9	

Note: Ratings range from 1 (poor) to 5 (excellent).

TABLE 1.

FUNCTIONAL ANALYSIS MATRIX -- FUNCTIONAL AREA: GROUND WATER TREATMENT

Evaluation Criteria	Weighting Factor	Air Stripping		Biological Treatment, Air Stripping		Odor Control, Air Stripping		Biological Treatment, Air Stripping, Precipitation/Flocculation	
		Rating	Comment	Rating	Comment	Rating	Comment	Rating	Comment
1. Reliability	1.1	4	Impacted by alkalinity and iron	3	Biological treatment requires additional operator attention	4	Impacted by alkalinity and iron	2	Dependent on continual process monitoring of mixing speed, chemical addition rate and overflow rate
2. Constructibility	0.6	5	Easily constructed as package system	3	Biological system requires additional unit, although package system is available	5	Easily constructed as package system	2	Construction involves mixing, flocculation, sedimentation, sludge withdrawal and storage areas
3. Implementation Time Frame	0.5	4	Can be on-line within 2 or 3 months	3	Increased number of process components increases implementation time frame	4	Can be on-line within 2 or 3 months	3	Implementation time frame is longer due to the complexity of the process and the number of process components
4. Environmental Effectiveness	2.0	4	Should alleviate ground water problems if clean background air is available and no other organic compounds other than benzene and toluene identified	4	Biological treatment required only for water discharge	3	Odor control with hydrogen peroxide would reduce organic content of waste stream making subsequent stripping easier. Phenol removal difficult	4	Provides most thorough treatment, but sludge dewatering and disposal practices must be managed properly to prevent contaminant release
Total		17.4		14.4		15.4		12.9	

Note: Ratings range from 1 (poor) to 5 (excellent).

FUNCTIONAL ANALYSIS MATRIX -- FUNCTIONAL AREA: GROUND WATER DISCHARGE

Evaluation Criteria	Weighting Factor	Pump, Treat, Recharge		Pump, Treat, Discharge to Surface Water	
		Rating	Comment	Rating	Comment
1. Reliability	1.1	1	Reliability of the process varies with the site subsurface conditions to be determined. May not be feasible without flooding and direct discharge to surface water	3	Potential for process upsets and degradation of receiving waters requires more complicated treatment
2. Constructibility	0.6	2	May require deep injection wells to prevent flooding of developed areas	3	Involves less complex construction than either recharge option
3. Implementation Time Frame	0.5	3	Extensive due to required SDWA/UIC permit, subsurface investigation and construction of recharge system	3	Implementation time less than the recharge options
4. Environmental Effectiveness	2.0	4	Recharged water would meet DWS	4	Requires treatment to a level that ensures maintenance of surface water quality standards
Total		11.8		14.6	

Note: Ratings range from 1 (poor) to 5 (excellent).

TABLE 14

COST COMPARISON OF SELECTED ALTERNATIVES FROM GROUND WATER FUNCTIONAL ANALYSIS RESULTS

Remedial Alternative/Description	Capital Cost	O&M Cost	Total Implementation Cost	Recommended Ranking	Ranking Rationale
I. Hot spot recovery, treatment with odor control, air stripping, recharge on-site	$0.8 M	$0.14^{(2)}$	$0.94M	3	- Least stringent treatment required, roughly one-fourth the cost of highest ranked alternative
II. Downgradient of site, recovery, treatment with odor control, air stripping, discharge to surface water	$1.25 M	$2.4 M^{(3)}$	$3.65 M	1	- Stringent treatment required to meet surface water criteria.
III. Downgradient of plume recovery, treatment with odor control, RBC, air stripping, metals removal discharge to surface water	$4.5 M	$6.5 M^{(3)}$	$11.0 M	2	- More than triple the cost of highest ranked alternative without significant benefit

Notes:

1. See Appendix for detailed Cost Estimates.
2. 6-Month O&M period for Alternative I
3. 15-Year O&M period for Alternatives II and III.

TABLE 15

WASTE DEPOSIT AND CONTAMINATED SOIL/SEDIMENT CONTROL REMEDIAL METHODS OMITTED FROM FURTHER CONSIDERATION

Remedial Method	Omission Rationale
Soil/Sediment Treatment	
1. Stabilization/solidification/reburial	Cost, Environmental Effectiveness, Negative Environmental Impact Potential, Feasibility and Reliability: Cost of encapsulation/reburial of any or all of the wastes on-site is an order of magnitude greater than burial alone. Wastes must undergo thorough analytical characterization and pilot stabilization testing to ensure compatibility with a specific waste. The heterogeneous nature of the hide piles renders this technique infeasible.
2. Encapsulation/reburial	Feasibility and Reliability: The encapsulation process has yet to be applied on a large commercial scale under actual field conditions.
3. Incineration/residue reburial	Feasibility and Reliability: Incineration is infeasible for heavy metal removal.
4. Wet air oxidation/residue reburial	Same rationale as No. 3 above.
5. Land farming	Feasibility and Reliability: Landfarming infeasibile for heavy metals removal.
6. In situ microbial degradation	Same rationale as No. 5 above.
7. In situ solution mining	Feasibility and Reliability: Requires homogeneous waste that is mobile and that can be entrained in a solvent phase, contaminants in the soils have proven immobile over time and hide piles present a very heterogeneous environment.
8. In situ neutralization/detoxification	Feasibility and Reliability, Negative Environmental Impact Potential: Heterogeneous nature of wastes result in the potential for poor contact with neutralization medium. Toxic by-products could be generated as a result of the heterogeneous mixture of wastes and presence of heavy metals.

TABLE 16

FUNCTIONAL ANALYSIS MATRIX -- FUNCTIONAL AREA: CONTAMINATED SOILS

Evaluation Criteria	Weighting Factor	Alternative I		Alternative II		Alternative III		Alternative IV	
		Rating	Comment	Rating	Comment	Rating	Comment	Rating	Comment
1. Reliability	1.1	4	Reduces both potential for contact and rainwater infiltration	4	Reduces both potential for contact and rainwater infiltration	4	Reduces both potential for contact and rainwater infiltration	4	Reduces both potential for contact and rainwater infiltration
2. Constructability	0.6	4	Common civil engineering technique	4	Common civil engineering technique	4	Common civil engineering technique	4	Common civil engineering technique
3. Impelmentation Time Frame	0.5	3	Compaction required for large soil volume	3	Compaction required for large soil volume	4	Less layers than Alternatives I and II	2	More layers than Alternatives I and II
4. Environmental Effectiveness	2.0	4	Some portions of site may be difficult to completely seal	3	Additional infiltration compared to Alternatives I and IV	4	Would treat metals in ground water if necessary	4	Some portions of site may be difficult to completely seal
5. Future Land Use	0.5	1	Precludes development on 70 acres	1	Precludes development on 70 acres	3	Does not preclude development. Requires deed restrictions.	1	Precludes development on 70 acres
Total		16.8		14.8		18.3		16.3	

Note:

Ratings range from 1 (poor) to 5 (excellent).
Alternative I - 24" clay, 6" cover, vegetate.
Alternative II - 6" clay, 18" fill, 6" cover, vegetate.
Alternative III - 24" offsite fill, 6" cover, vegetate
Alternative IV - 20 mil PVC liner, 12" sand beds, 12" fill, 6" cover, vegetate

IN RI/FS	IN ROD
I	S-2
II	S-3
III	S-4
IV	S-5
V	S-6
VI	S-7
VII	S-8
VIII	S-9
IX	S-10
X	S-11
XI	S-12

TABLE 17

TABLE 17 cont'c

FUNCTIONAL ANALYSIS MATRIX -- FUNCTIONAL AREA: CONTAMINATED SOILS (Continued)

Evaluation Criteria	Weighting Factor	Alternative V Rating	Alternative V Comment	Alternative VI Rating	Alternative VI Comment	Alternative VII Rating	Alternative VII Comment	Alternative VIII Rating	Alternative VIII Comment
1. Reliability	1.1	3	Reduces potential for contact	4	Allows future site develop-on portion of property and minimizes poten-tional for contact	5	Allows site development on large portion of property	5	Allows site development on large portion of property
2. Constructibility	0.6	5	Common Civil engineering methods	2	Requires access roads, relocation system design and leachate collection system	2	Requires safety precautions and coordination	2	Requires safety precautions and coordination
3. Implementation Time Frame	0.5	5	Short-term due to minimal earthwork required	1	Long-term due to large volume of soil being excavated and and relocated fill required	1	Long-term due to large volume of soil being excavated, relocated and back-	2	Less time than Alternative VII since no backfill required
4. Environmental Effectiveness	2.0	3	Would treat metals in ground water if necessary	3	Excellent long-term effectiveness due to odor	4	Would limit infiltration and gaseous emissions	4	Would limit infiltration and gaseous emissions
5. Future Land Use	0.5	4	Does not preclude development of site. Requires deed restrictions.	3	Precludes development on 13.6 acres	3	Precludes development on 15 acres	3	Precludes development on 15 acres
Total		16.8		13.6		16.7		17.2	

Note:

Ratings range from 1 (poor) to 5 (excellent)
Alternative V - 6 inch cover, vegetate, deed restrictions
Alternative VI - Construct RCRA landfill
Alternative VII - Consolidate and cover with 24" backfill, 6" soil, backfill
Alternative VIII - Consolidate and cover with 24" backfill. 6" soil, no backfill

TABLE 17 cont'd

FUNCTIONAL ANALYSIS MATRIX -- FUNCTIONAL AREA: CONTAMINATED SOILS (Continued)

Evaluation Criteria	Weighting Factor	Alternative IX		Alternative X		Alternative XI	
		Rating	Comment	Rating	Comment	Rating	Comment
1. Reliability	1.1	3	Reduces potential for contact	4	Allows future site development on portion of property and minimizes potential for contact	3	Reduces potential for contact
2. Constructibility	0.6	5	Limited excavation, fence and deed restrictions	4	Common civil engineering technique	5	Common civil engineering technique
3. Implementation Time Frame	0.5	4	Readily implemented	4	Readily implemented	4	Short-term due to less earthwork required
4. Environmental Effectiveness	2.0	2	Would treat metals in ground water if necessary. Less cover than other options.	4	Would treat metals in ground water if necessary	3	Would treat metals in ground water if necessary
5. Future Land Use	0.5	5	Does not preclude development. Required deed restrictions	4	Does not preclude development. Required deed restrictions.	4	Does not preclude development. Required deed restrictions
Total		14.8		18.8		16.3	

Note:

Ratings range from 1 (poor) to 5 (excellent)

Alternative IX - Limited excavation and relocation of ditch along New Boston Streets, fence and deed restrictions

Alternative X - Limited excavation and relocatiop of ditch along New Boston Street, fence and deed restrictions. Cover areas in top 2 feet greater than either 300 ppm As, 600 ppm Pb or 1,000 ppm Cr with 30 inch fill/soil.

Alternative XI - Limited excavation and relocation of ditch along New Boston Street, fence and deed restrictions. Cover areas in top 2 feet greater than either 300 ppm As, 600 ppm Pb or 1,000 ppm Cr with 6" fill/soil

TABLE 18

COST COMPARISON OF SELECTED ALTERNATIVES FROM CONTAMINATED SOILS FUNCTIONAL ANALYSIS RESULTS

Remedial Alternative/Description	Functional Analysis Value	Capital Cost	O&M Cost	Total Implementation Cost	Ranking	Ranking Rationale
I 24" clay, 6" cover, vegetate	16.8	$22.7 M	$1 M	$23.7 M	8	- Good functional analysis - High cost
II 6" clay, 18" fill, 6" cover, vegetate	14.8	$12.3 M	$1 M	$13.3 M	10	- Low functional analysis - Moderate cost
III 24" fill, 6" cover, vegetate	18.3	$ 8.2 M	$1 M	$ 9.2 M	2	- High functional analysis - Moderate cost
IV 20 mil PVC liner, 12" sand, 12" fill, 6" cover, vegetate	16.3	$11.4 M	$1 M	$12.4 M	7	- Good functional analysis - Moderate cost
V 6" cover, vegetate, deed restrictions	16.8	$ 4.1 M	$1 M	$ 5.1 M	3	- Good functional analysis - Low cost
VI RCRA landfill	13.6	$79.0 M	$1 M	$80.0 M	11	- Lowest functional analysis - Highest cost
VII Consolidate, cover with 30" fill, 20 mil PVC, backfill of excavated areas	16.7	$18.0 M	$1 M	$19.0 M	9	- Good functional analysis - High cost
VIII Consolidate, cover with 30" fill, 20 mil PVC, no backfill of excavated areas	17.2	$ 9.0 M	$1 M	$10.0 M	5	- High functional analysis - Moderate cost
IX Limited excavation and relocation of ditch along New Boston Street, fence, deed restrictions	14.8	$ 2.3 M	$1 M	$ 3.3 M	6	- Low functional analysis - Lowest cost

TABLE 18 cont'd

COST COMPARISON OF SELECTED ALTERNATIVES FROM CONTAMINATED SOIL FUNCTIONAL ANALYSIS RESULTS (Continued)

Remedial Alternative/Description	Functional Analysis Value	Capital Cost	O&M Cost	Total Implementation Cost	Ranking	Ranking Rationale
X Cover areas in top 2' greater than either 300 ppm As, 600 ppm Pb or 1,000 ppm Cr with 30 inch fill/soil	18.8	$ 5.3 M	$1 M	$ 6.3 M	1	- Highest functional analysis - Moderate cost
XI Cover areas in top 2' greater than either 300 ppm As, 600 ppm Pb or 1,000 ppm Cr with 6 inch fill/soil	16.3	$ 3.0	$1 M	$ 4.0 M	4	- Good functional analysis - Low cost

AIR EMISSIONS METHODS OMITTED FROM FURTHER CONSIDERATION

Remedial Method	Omission Rationale
Gas Control	
1. Urea-Formaldehyde barriers	Feasibility and Reliability: Effective permeability of foam can be unreliable due to frequently encountered installation problems.
2. Tall Stack Dispersion	Feasibility and Reliability: Under current policy, tall stack dispersion is not acceptable to Massachusetts DEQE for odor control.
Gas Treatment	
1. Chemical Oxidation	Environmental Effectiveness: Chemical oxidation using ozone or hydrogen peroxide has potential to generate hazardous waste.
2. Ion Exchange	Feasibility and Reliability: Not as reliable as more commonly used carbon adsorption.
3. Excavate and Remove East Hide Pile	Cost, Negative Environmental Impact Potential: Cost would be an order of magnitude greater than other feasible alternatives. In addition, tremendous odor generation would result from unearthing decomposing waste material.
4. Stabilization	Environmental Effectiveness: Stabilization using lime or sodium biocarbonate has not been proven effective for reducing emission rates in landfills.

TABLE 1

TABLE 2C

FUNCTIONAL ANALYSIS MATRIX -- FUNCTIONAL AREA: EAST HIDE PILE

Evaluation Criteria	Weighting Factor	Alternative A-2 Rating	Alternative A-2 Comment	Alternative A-3 Rating	Alternative A-3 Comment	Alternative A-4 Rating	Alternative A-4 Comment
1. Reliability	1.1	2	Pressure buildup may jeopardize cap	4	Carbons beds will require regular maintenance to assure reliability	4	Thermal oxidation requires inspection and maintenance to assure reliability
2. Constructibility	0.6	5	Common civil engineering methods	3	Treatment unit reduces constructibility	3	Treatment unit connection to gas collection piping reduces constructibility
3. Implementation Time Frame	0.5	5	Easiest to install due to minimal earthwork and lack of collection pipes	4	Installation of gas collection system and synthetic liner may involve slight delay	4	Installation of gas collection system and synthetic liner may involve slight delay
4. Environmental Effectiveness	2.0	1	Hydrogen sulfide gas may escape via ground water or fissures	4	Will treat emissions and assure negligible internal pressure buildup	4	Will treat emissions and assure negligible interal pressure buildup
Total		9.7		16.2		16.2	

Notes:

Ratings range from 1 (poor) to 5 (excellent).

Alternative A-2- Modify slope with new fill, install synthetic membrane liner cap, cover with topsoil, and establish vegetation

Alternative A-3- Modify slope with new fill, install gas collection system piping, install synthetic membrane liner cap, cover with topsoil, establish vegetation, carbon adsorption unit and 12-foot stack

Alternative A-4- Modify slope with new fill, install gas collection system piping, install synthetic membrane liner cap, cover with topsoil, establish vegetation, thermal oxidation unit and 30-foot stack, propane storage.

TABLE 21

COST COMPARISON OF SELECTED ALTERNATIVES FROM EAST HIDE PILE FUNCTIONAL ANALYSIS RESULTS

Remedial Alternative/Description		Capital Cost	O&M Cost	Total Implementation Cost	Recommended Ranking	Ranking Rationale
A-2	Modify slopes with new fill, install synthetic membrane liner cap, cover with top soil and establish vegetation	\$1.86 M(1)	\$0(2)	\$1.86 M	2	Questionable reliability and environmental effectiveness
A-3	Modify slopes with new fill, install gas collection system piping, install synthetic membrane liner cap, cover with topsoil and establish vegetation, blower system, carbon adsorption unit, 12 foot stack	\$2.36 M	\$0.30 M(3)	\$2.66 M	1	To be evaluated during pilot testing
A-4	Modify slopes with new fill, install gas collection system piping, install synthetic membrane liner cap, cover with topsoil and establish vegetation, blower system, thermal oxidation unit, 3,000 gallon propane storage tank, 20 foot stack	\$2.50 M	\$0.50 M(3)	\$3.00 M	1	To be evaluated during pilot testing

Notes:

1. Cost includes air monitoring. See Figure 3-7 for air monitoring flowchart.
2. O&M costs for Alternative I are considered zero because these costs are absorbed in the overall site monitoring.
3. O&M costs for Alternatives II and III are based on a 15-year life.

ALTERNATIVE GW-2

CAPITAL COST INTERCEPTOR WELL SYSTEM - HOT SPOT RECOVERY

DRILL FIVE INTERCEPTOR WELLS		$ 24,000
SUPPLY AND INSTALL FIVE 10-20 GPM SUBMERSIBLE 316SS IMPELLOR PUMPS		5,000
SUPPLY AND INSTALL WELL MANIFOLD AND DISCHARGE LINE		17,000
ELECTRIC SUPPLY FOR PUMPS		1,000
MISCELLANEOUS		2,000
INSTALL EIGHT 2" dia. PIEZOMETER WELLS		10,000
GROUNDWATER CONSULTANTS COSTS		26,000
Interceptor Wells		
Piezometer Wells		
Pumping Test		
Start-up		
Pumping OW-16		
Report Writing and Issue		
SITE IMPROVEMENTS		
.5 Acres of Land	53,000	
30' x 40' Pre-engineered Building	76,000	
40' x 50' Curbed Concrete Slabs	11,000	
50' x 60' Fenced Enclosure	5,000	
Site Lighting, Grounding	4,000	
Furniture, Safety Supplies	1,000	
		150,000
VOC STRIPPING COST		
100 GPM Pump C.I.	3,000	
1000 ACFM Blower FRP	2,000	
Two 48"dia.x35' High Packed Towers 304SS	66,000	
Piping, Valves	9,000	
Electrical	1,000	
Instrumentation	5,000	
Painting	1,000	
		87,000

TABLE 22

ODOR REMOVAL		
5% Fe Cl_2 Tank 200 Gal. PPL	1,000	
50% H_2O_2 Tank 7000 Gal. Alum.	21,000	
Groundwater Tnk 8000 Gal Fiberglass	10,000	
Mixer 316 SS	2,000	
Metering Pumps (2) 0 to 1.7 GPM	1,000	
Pulsefeeders (2) 3 GPH 316SS	1,000	
Agitator 1/3 HP 304 SS	1,000	
Agitator 5 HP 304 SS	3,000	
Piping, Valves	7,000	
Electrical	5,000	
Instrumentation	-	
Insulation	1,000	
Paint	1,000	
		54,000
TOTAL DIRECTS		**$ 376,000**
CONSTRUCTION EXPENSE 6 Months Duration @ $20,000/Month		120,000
PREMIUM ON OVERTIME		5,000
ENGINEERING Wells $85,000 @ 5% Other $150,000 + 37,000 + 54,000 @ 15%		50,000
PUNCH LIST		5,000
SPARE PARTS		8,000
Sub-Total		$ 564,000
CONTINGENCY & ESCALATION		226,000
CAPITAL COST		**$ 790,000**

OPERATING AND MAINTENANCE COSTS INTERCEPTOR WELLS HOT SPOT RECOVERY

Operating and Maintenance Costs for minimum six month Duration is estimated at $140,000.

ALTERNATIVE GW-3

CAPITAL COST INTERCEPTOR WELL SYSTEM - 110 GPM

COSTS OF FIVE INTERCEPTOR WELL SYSTEMS		$ 85,000
COSTS OF:		
Site Improvements	150,000	
VOC Stripping	87,000	
Odor Control	54,000	
		291,000
TOTAL DIRECTS		$ 376,000
INDIRECT COSTS		
Construction Expense	120,000	
Premium on Overtime	5,000	
Engineering	50,000	
Punch List	5,000	
Spare Parts	8,000	
		188,000
Sub-Total		$ 564,000
CONTINGENCY & ESCALATION		226,000
Sub-Total		$ 790,000
BOD Removal Costs from "Handbook for Remedial Action at Waste Disposal Sites" EPA-625/6-82-006, June 1982, Pg. 229. Package Plant; Activated Sludge; Extended Aeration; 2 Stages; Includes Chlorination and Secondary Clarification.		460,000
TOTAL CAPITAL COST		**$1,250,000**

TABLE 23

ALTERNATIVE GW-3 cont'd

OPERATING AND MAINTENANCE COSTS INTERCEPTOR WELLS 110 GPM

Supplies			$14,000
H_2O_2 84#/day @ .45/#		$13,800	
$FeCl_2$ Negligible amount per year		200	
Electrical			32,000
Well Pumps (5)	7.5 HP		
Stripper Pump (2)	6.		
Blowers (2)	10.		
Metering Pumps (2)	2.		
Agitator (2)	6.		
	31.5 HP or	23.5 KW	
Building and Site Lighting 30'x40'		5.0	
Heat Tracing Assume 5 Watts/LF of Pipe 100 feet of 2"0 Pipe 6 mo. Usage Factor .6 Utilization Factor		1.8	
		30.3 KW/HR @ $.12/KWH	
Heating Assume 20 Gal/Day of Propane @ $1.50/Gal. for Six Months			5,000
Maintenance Assume 5% of Capital Cost ($376,000 x 5%)			19,000
Operation and Supervision Assume Eight Hour Shift, 365 Days @ $30/Hour			88,000
		Sub Total	$158,000

TABLE 23 cont'd

OPERATING AND MAINTENANCE COSTS BOD REMOVAL SYSTEM

Supplies		-
Electrical		3,000
Rotating Disc Aerator	3 HP	
Blowers	1	
	4 HP or 2.98 KW/HR @ $.12/KWH	
Heating		-
Maintenance Assume half of total cost of $460,000 is equipment. Maintenance costs are 5% ($230,000 x 5%)		12,000
Operation and Supervision Included with Interceptor Wells		-
	Sub Total	15,000
TOTAL INTERCEPTOR WELLS		$158,000
BOD REMOVAL		15,000
	Sub Total	$173,000
Contingency		52,000
	TOTAL OPERATING AND MAINTENANCE COSTS	$225,000

TABLE 24

ALTERNATIVE GW-4

CAPITAL COST INTERCEPTOR WELL SYSTEM - 360 GPM

COSTS OF FIVE INTERCEPTOR WELL SYSTEMS $85,000. Costs are increased 30% to account for larger diameter wells and installation of two wells in a lake in lieu of dry land.		$ 110,000
COSTS OF:		
Site Improvements	150,000	
VOC Stripping	87,000	
Odor Control	54,000	
Increase Size of Ageing Tank in Odor Control	21,000	
		312,000
TOTAL DIRECTS		$ 422,000
CONSTRUCTION EXPENSE 7 Months @ $20,000/Month		140,000
PREMIUM ON OVERTIME		5,000
ENGINEERING Wells - $110,000 @ 5% Other - $150,000 + 87,000 + 75,000 @ 15%		53,000
PUNCH LIST		5,000
SPARE PARTS		8,000
Sub-Total		$ 633,000
CONTINGENCY & ESCALATION		257,000
Sub-Total		$ 890,000
BOD Removal Costs from "Handbook for Remedial Action at Waste Disposal Sites" EPA-625/6-82-006, June 1982, Pg. 229. Package Plant; Activated Sludge; Extended Aeration; 2 Stages; Includes Chlorination and Secondary Clarification.		460,000
TOTAL CAPITAL COST		**$1,350,000**

OPERATING AND MAINTENANCE COSTS INTERCEPTOR WELLS 360 GPM

Total Operating and Maintenance Costs (Present worth in 1985 dollars)	$2,360,000

Assumed to be the same as 110 GPM

TABLE 25

TABLE 26

CAPITAL COST HEAVY METALS REMOVAL SYSTEM 110 GPM

Process Equipment			
Sulfex™ Process consisting of Single Stage Neutralization followed by 2-Stage Clarification, Filtration and Sludge Dewatering	$646,000		
50% Caustic Storage and Feed System 5,000 Gal.	22,000		
Sludge Conveyor	12,000		
			$680,000
Safety and Fire Equipment			4,000
Building 30'W.x80'L. Pre-engineered, Insulated Building			151,000
Substructures			50,000
Rigging			26,000
Piping			29,000
Electrical			78,000
Instrumentation			22,000
Insulation			3,000
Painting			6,000
		TOTAL DIRECTS	**$1,049,000**
Construction Expense 6 months duration @ $20,000/month			120,000
Premium on Overtime			5,000
Engineering Package $600,000 @ 5% Other $449,000 @ 15%			100,000
Punch List			10,000
Spare Parts			14,000
		Sub Total	**$1,298,000**
Contingency and Escalation			392,000
		Sub Total	**$1,690,000**
Allowance for .5 acre Land Purchase, Site Improvements, Fence			110,000
		Capital Cost	**$1,800,000**
15-Year Monitoring Costs (Present worth in 1985 dollars)			NONE
Operating and Maintenance Costs (Present worth in 1985 dollars)			$2,200,000
		TOTAL IMPLEMENTATION COST	**$4,000,000**

CAPITAL COST HEAVY METALS REMOVAL SYSTEM 360 GPM

Process Equipment Sulfex™ Process for 110 GPM Scaled up to 360 GPM using .6 Scale Up Factor		$1,360,000
Safety and Fire Equipment		4,000
Building 40'W.x100'L. Pre-engineered Insulated Building		250,000
Substructures		95,000
Rigging		54,000
Piping		54,000
Electrical		163,000
Instrumentation		41,000
Insulation		9,000
Painting		5,000
	TOTAL DIRECTS	**$2,035,000**
Construction Expense 6 months duration @ $20,000/month		120,000
Premium on Overtime		5,000
Engineering Package $1,360,000 @ 5% Other $ 675,000 @ 15%		169,000
Punch List		20,000
Spare Parts		27,000
	Sub Total	**$2,376,000**
Contingency and Escalation		714,000
	Sub Total	**$3,090,000**
Allowance for .5 acre Land Purchase, Site Improvements, Fence		60,000
	Capital Cost	**$3,150,000**

TABLE 27

OPERATING AND MAINTENANCE COSTS HEAVY METALS REMOVAL SYSTEM
110 GPM

Supplies		$26,000
Total Reagents Cost	$22,400	
(F. Heinze 11/6/85 memo E/R 1600E423)		
50% caustic 10 Gal/Day, 12.76#/Gal @ .0787#	3,600	
Electrical		53,000
Sulfex System Horsepower		
Assume 50HP or	37.3 KW	
Building and Site Lighting 30'x80'	10.0	
Heat Tracing	2.7	
Assume 5 Watts/LF of Pipe		
150 feet of 2"0 Pipe		
6 mo. Usage Factor		
.6 Utilization Factor		
	50.0 KW/HR @ $.12/KWH	
Heating		14,000
Assume 50 Gal/Day of Propane @ $1.50/Gal. for six months		
Maintenance		52,000
Assume 5% of Capital Cost ($1,049,000 x 5%)		
Operation and Supervision		
Included with Operating Costs of Interceptor Well System		-
Disposal Costs		15,000
Sub Total		**$160,000**
Contingency		50,000
TOTAL OPERATING AND MAINTENANCE COSTS		**$210,000**

TABLE 28

OPERATING AND MAINTENANCE COSTS HEAVY METALS REMOVAL SYSTEM 360 GPM

Supplies		$26,000
Same as 110 GPM		
Electrical		140,000
Power 150 HP or	112 KW	
Lighting	15	
Heat Tracing	5	
	132 KW/HR @ $.12/KWH	
Heating		20,000
Maintenance		101,000
Assume 5% of Capital Cost ($2,035,000 x 5%)		
Operation and Supervision		
Same as 110 GPM		
Disposal Costs		
Same as 110 GPM		15,000
	Sub Total	**$302,000**
Contingency		88,000
TOTAL OPERATING AND MAINTENANCE COSTS		**$390,000**

Allow for 6% annual inflation per annum discounted at 12% per annum for 15 years to determine total monitoring and maintenance costs (present worth in 1985 dollars).

For 110 GPM Ststem	Annual O&M Cost	$ 210,000
	15-year O&M Costs (Present worth)	$2,200,000

$$\frac{\$2,200,000}{\$210,000} = 10.5$$

Therefore for 360 GPM Annual O&M Cost $390,000
X 10.5

TOTAL OPERATING AND MAINTENANCE COSTS HEAVY METALS REMOVAL SYSTEM 360 GPM **$4,100,000**
(Present worth in 1985 dollars)

TABLE 29

ALTERNATIVE S-2

A. Cover all As, Cr, Pb Waste Deposits with individual concentrations of one or more exceeding 100 PPM, and cover the East Central and the West Hide Deposit.

Cut, fill, regrade the top 12" of the existing surface to develop new contours, eliminate water pockets, promote better drainage, etc.	$ 707,000
Cover area with a 24" clay barrier constructed in 6" lifts. This clay barrier is composed of Betonite Clay mixed at a rate of four pounds per square foot with native offsite soil to achieve 10^{-7} permeability.	9,889,000
Cover clay barrier with a 6" layer of top soil and vegetate.	621,000
Relocate the South Hide Pile (include 25% swell up factor) to reshape the West Hide Pile slope (allow for one half of costs).	292,000
Cover former South Hide Area with a 6" layer of top soil and vegetate.	10,000
Reshape the slopes of the West Hide Pile using South Hide materials (allow for one half of costs).	265,000
Drain Wetlands with 60" dia. underground polyethylene pipe to stabilize hide pile slopes (allow for one half of costs).	200,000
Cover area with a 24" clay barrier constructed in 6" lifts. This clay barrier is composed of Bentonite Clay mixed at a rate of four pounds per square foot with native offsite soil to achieve 10^{-7} permeability.	630,000
Cover clay barrier with a 6" layer of top soil and vegetate.	40,000
TOTAL DIRECTS	$12,654,000
Site Overhead Costs Surveying and Test Borings Dewatering Mobilization and Demobilization Equipment and Personnel Downtime	1,504,000
Indirect Costs Site Facility Costs Stauffer Engineering & Research Personnel Outside Analytical Contractors	2,095,000
Sub-Total	$16,253,000
Contingency and Escalation	6,397,000
CAPITAL COST	$22,650,000

TABLE 30

ALTERNATIVE S-3

A. Cover all As, Cr, Pb Waste Deposits with individual concentrations of one or more exceeding 100 PPM, and cover the East Central and the West Hide Deposit.

Cut, fill, regrade the top 12" of the existing surface to develop new contours, eliminate water pockets, promote better drainage, etc.	$ 707,000
Cover area with a 6" clay barrier. This clay barrier is composed of Betonite Clay mixed at a rate of four pounds per square foot with native soil to achieve 10^{-7} permeability.	2,543,000
Cover clay barrier with an 18" layer of offsite fill (includes 20% compaction factor).	1,695,000
Cover fill a 6" layer of top soil and vegetate. and vegetate.	621,000
Relocate the South Hide Pile (include 25% swell up factor) to reshape the West Hide Pile slope (allow for one half of costs).	292,000
Cover former South Hide Area with a 6" layer of top soil and vegetate.	10,000
Reshape the slopes of the West Hide Pile using South Hide materials (allow for one half of costs).	265,000
Drain Wetlands with 60" dia. underground polyethylene pipe to stabilize hide pile slopes (allow for one half of costs).	200,000
Cover area with a 6" clay barrier. This clay barrier is composed of Bentonite Clay mixed at a rate of four pounds per square foot with native offsite soil to achieve 10^{-7} permeability.	162,000
Cover clay barrier with an 18" layer of offsite fill (includes 20% compaction factor).	108,000
Cover fill with a 6" layer of top soil and vegetate.	40,000
TOTAL DIRECTS	$ 6,643,000
Site Overhead Costs Surveying and Test Borings Dewatering Mobilization and Demobilization Equipment and Personnel Downtime	998,000
Indirect Costs Site Facility Costs Stauffer Engineering & Research Personnel Outside Analytical Contractors	1,146,000
Sub-Total	$ 8,787,000
Contingency and Escalation	3,513,000
CAPITAL COST	**$12,300,000**

TABLE 31

A. Cover all As, Cr, Pb Waste Deposits with individual concentrations of one or more exceeding 100 PPM, and cover the East Central and the West Hide Deposit.

Cut, fill, regrade the top 12" of the existing surface to develop new contours, eliminate water pockets, promote better drainage, etc.	$ 707,000
Cover area with a 24" layer of offsite fill (includes 20% compaction factor).	2,261,000
Cover fill with a 6" layer of top soil and vegetate.	621,000
Relocate the South Hide Pile (include 25% swell up factor) to reshape the West Hide Pile slope (allow for one half of costs).	292,000
Cover former South Hide Area with a 6" layer of top soil and vegetate.	10,000
Reshape the slopes of the West Hide Pile using South Hide materials (allow for one half of costs).	265,000
Drain Wetlands with 60" dia. underground polyethylene pipe to stabilize hide pile slopes (allow for one half of costs).	200,000
Cover area with a 24" layer of offsite fill (includes 20% compaction factor).	144,000
Cover fill with a 6" layer of top soil and vegetate.	40,000
TOTAL DIRECTS	$ 4,540,000
Site Overhead Costs	545,000
Surveying and Test Borings	
Dewatering	-
Mobilization and Demobilization	-
Equipment and Personnel Downtime	-
Indirect Costs	764,000
Site Facility Costs	
Stauffer Engineering & Research Personnel	
Outside Analytical Contractors	
Sub-Total	$ 5,849,000
Contingency and Escalation	2,331,000
CAPITAL COST	**$ 8,180,000**

TABLE 32

A. Cover all As, Cr, Pb Waste Deposits with individual concentrations of one or more exceeding 100 PPM, and cover the East Central and the West Hide Deposit.

Cut, fill, regrade the top 12" of the existing surface to develop new contours, eliminate water pockets, promote better drainage, etc.	$ 707,000
Cover area with a 6" layer of compacted sand. Install a 20 mil PVC membrane liner. Install a 6" layer of compacted sand over the PVC liner.	2,825,000
Cover liner and sand with a 12" layer of offsite fill (includes 20% compaction factor).	1,131,000
Cover fill with a 6" layer of top soil and vegetate.	621,000
Relocate the South Hide Pile (include 25% swell up factor) to reshape the West Hide Pile slope (allow for one half of costs).	292,000
Cover former South Hide Area with a 6" layer of top soil and vegetate.	10,000
Reshape the slopes of the West Hide Pile using South Hide materials (allow for one half of costs).	265,000
Drain Wetlands with 60" dia. underground polyethylene pipe to stabilize hide pile slopes (allow for one half of costs).	200,000
Cover area with a 6" layer of compacted sand. Install a 20 mil PVC membrane liner. Install a 6" layer of compacted sand over the PVC liner.	180,000
Cover liner and sand with a 12" layer of offsite fill (includes 20% compaction factor).	72,000
Cover fill with a 6" layer of top soil and vegetate.	40,000
TOTAL DIRECTS	$ 6,343,000
Site Overhead Costs Surveying and Test Borings Dewatering Mobilization and Demobilization Equipment and Personnel Downtime	760,000
Indirect Costs Site Facility Costs Stauffer Engineering & Research Personnel Outside Analytical Contractors	1,066,000
Sub-Total	$ 8,169,000
Contingency and Escalation	3,261,000
CAPITAL COST	**$11,430,000**

TABLE 33

ALTERNATIVE S-6

A. Cover all As, Cr, Pb Waste Deposits with individual concentrations of one or more exceeding 100 PPM, and cover the East Central and the West Hide Deposit.

Limited excavation at the PX Engineering site.

Cut, fill, regrade the top 12" of the existing surface to develop new contours, eliminate water pockets, promote better drainage, etc.	$ 706,000
Cover area with a 6" layer of top soil and vegetate.	621,000
Relocate the South Hide Pile (include 25% swell up factor) to reshape the West Hide Pile slope (allow for one half of costs).	292,000
Cover former South Hide Area with a 6" layer of top soil and vegetate.	10,000
Reshape the slopes of the West Hide Pile using South Hide materials (allow for one half of costs).	265,000
Drain Wetlands with 60" dia. underground polyethylene pipe to stabilize hide pile slopes (allow for one half of costs).	200,000
Cover area with a 6" layer of top soil and vegetate.	40,000
Excavate limited quantities of waste deposits from the PX engineering site. Transport to East/West Hide Deposit area (includes 25% swell-up factor).	38,000
Backfill excavated areas (includes 20% compaction factor).	77,000
TOTAL DIRECTS	$ 2,249,000
Site Overhead Costs Surveying and Test Borings Dewatering Mobilization and Demobilization Equipment and Personnel Downtime	270,000
Indirect Costs Site Facility Costs Stauffer Engineering & Research Personnel Outside Analytical Contractors	378,000
Sub-Total	$ 2,897,000
Contingency and Escalation	1,153,000
CAPITAL COST	**$ 4,050,000**

TABLE 34

A. Remove all As, Cr, Pb Waste Deposits with individual concentrations of one or more exceeding 100 PPM, and remove the East Central, the West, and the South Hide Deposit.

Construct a RCRA onsite containment facility.		$ 22,838,000
Remove and replace waste deposits.		13,334,000
	TOTAL DIRECTS	$36,172,000
Site Overhead Costs Surveying and Test Borings Dewatering Mobilization and Demobilization Equipment and Personnel Downtime		4,702,000
Indirect Costs Site Facility Costs Stauffer Engineering & Research Personnel Outside Analytical Contractors		15,554,000
	Sub-Total	$56,428,000
Contingency and Escalation		22,552,000
	CAPITAL COST	**$78,980,000**

TABLE 35

ALTERNATIVE S-8

A. Remove all As, Cr, Pb Waste Deposits with individual concentrations of one or more exceeding 100 PPM; consolidate on the East Central/West Hide deposit areas; and cover the East Central and the West Hide Deposit.

Consolidation of 460,000 CY of waste deposits on the approximately 15 acres of the East Central/West Hide Deposit area will raise the elevation by 18 to 20 feet. Therefore, increase surface area by 15% to account for height.

Cut, fill, regrade the top 12" of the existing East Central Hide Pile surface to develop new contours, eliminate water pockets, promote better drainage, etc.	$ 118,000
Excavate and relocate (includes 25% swell up factor).	2,588,000
Backfill excavated areas (includes 20% compaction factor).	4,968,000
Cover area with a 6" layer of compacted sand. Install a 20 mil PVC membrane liner. Install a 6" layer of compacted sand over the PVC liner.	750,000
Cover liner and sand with a 12" layer of offsite fill (includes a 20% compaction factor).	300,000
Cover fill with a 6" layer of top soil and vegetate.	165,000
Relocate the South Hide Pile (include 25% swell up factor) to reshape the West Hide Pile slope (allow for one half of costs).	292,000
Cover former South Hide Area with a 6" layer of top soil and vegetate.	10,000
Reshape the slopes of the West Hide Pile using South Hide materials (allow for one half of costs).	265,000
Drain Wetlands with 60" dia. underground polyethylene pipe to stabilize hide pile slopes (allow for one half of costs).	200,000
Cover area with a 6" layer of compacted sand. Install a 20 mil PVC membrane liner. Install a 6" layer of compacted sand over the PVC liner.	180,000
Cover liner and sand with a 12" layer of offsite fill (includes 20% compaction factor).	72,000
Cover fill with a 6" layer of top soil and vegetate.	40,000
TOTAL DIRECTS	$ 9,948,000

TABLE 36

ALTERNATIVE S-8 cont'd

Site Overhead Costs		1,194,000
Surveying and Test Borings		
Dewatering		
Mobilization and Demobilization		
Equipment and Personnel Downtime		
Indirect Costs		1,671,000
Site Facility Costs		
Stauffer Engineering & Research Personnel		
Outside Analytical Contractors		
	Sub-Total	$12,813,000
Contingency and Escalation		5,127,000
	CAPITAL COST	**$17,940,000**

TABLE 36 cont'd

A. Remove all As, Cr, Pb Waste Deposits with individual concentrations of one or more exceeding 100 PPM; consolidate on the East Central/West Hide deposit areas; and cover the East Central and the West Hide Deposit.

Consolidation of 460,000 CY of waste deposits on the approximately 15 acres of the East Central/West Hide Deposit area will raise the elevation by 18 to 20 feet. Therefore, increase surface area by 15% to account for height.

Cut, fill, regrade the top 12" of the existing East Central Hide Pile surface to develop new contours, eliminate water pockets, promote better drainage, etc.	$ 118,000
Excavate and relocate (includes 25% swell up factor).	2,588,000
Cover area with a 6" layer of compacted sand. Install a 20 mil PVC membrane liner. Install a 6" layer of compacted sand over the PVC liner.	750,000
Cover liner and sand with a 12" layer of offsite fill (includes a 20% compaction factor).	300,000
Cover fill with a 6" layer of top soil and vegetate.	165,000
Relocate the South Hide Pile (include 25% swell up factor) to reshape the West Hide Pile slope (allow for one half of costs).	292,000
Cover former South Hide Area with a 6" layer of top soil and vegetate.	10,000
Reshape the slopes of the West Hide Pile using South Hide materials (allow for one half of costs).	265,000
Drain Wetlands with 60" dia. underground polyethylene pipe to stabilize hide pile slopes (allow for one half of costs).	200,000
Cover area with a 6" layer of compacted sand. Install a 20 mil PVC membrane liner. Install a 6" layer of compacted sand over the PVC liner.	180,000

TABLE 37

ALTERNATIVE S-9 cont'd

Cover liner and sand with a 12" layer of offsite fill (includes 20% compaction factor).	72,000
Cover fill with a 6" layer of top soil and vegetate.	40,000
TOTAL DIRECTS	$ 4,980,000
Site Overhead Costs	598,000
Surveying and Test Borings	
Dewatering	
Mobilization and Demobilization	
Equipment and Personnel Downtime	
Indirect Costs	837,000
Site Facility Costs	
Stauffer Engineering & Research Personnel	
Outside Analytical Contractors	
Sub-Total	$ 6,415,000
Contingency and Escalation	2,565,000
CAPITAL COST	$ 8,980,000

TABLE 37 cont'd

ALTERNATIVE S-10

A. Fence areas of waste deposits, deed restrictions. Limited excavation at PX Engineering site. Cover the East Central and the West Hide Deposit.

Fencing Costs, Deed Restrictions:

Area	Fencing Footage	
PX Engineering	2700 LF	
Chromium Lagoons	1500	
Janpet	-	
Wedge Area	2000	
Arsenic/Phytotoxic Area	3000	
Stafford Lot	900	
	10100 LF	$ 173,000

Janpet - Presently fenced, therefore do nothing.
Chromium Lagoons - Only the triangular shaped area between the mainline railroad right of way and west of the railroad siding is to be fenced.

Excavate limited quantities of waste deposits from the PX engineering site, transport to East/West Hide Deposit area (includes 25% swell up factor).	38,000
Backfill excavated areas (includes 20% compaction factor).	77,000
Cut, fill, regrade the top 12" of the existing East Central Hide Pile surface to develop new contours, eliminate water pockets, promote better drainage, etc.	118,000
Cover fill with a 6" layer of top soil and vegetate.	104,000
Relocate the South Hide Pile (include 25% swell up factor) to reshape the West Hide Pile slope (allow for one half of costs).	292,000
Cover former South Hide Area with a 6" layer of top soil and vegetate.	10,000

TABLE 38

ALTERNATIVE S-10 cont'd

Reshape the slopes of the West Hide Pile using South Hide materials (allow for one half of costs).	265,000
Drain Wetlands with 60" dia. underground polyethylene pipe to stabilize hide pile slopes (allow for one half of costs).	200,000
Cover area with a 6" layer of top soil and vegetate.	40,000
TOTAL DIRECTS	$ 1,317,000
Site Overhead Costs Surveying and Test Borings Dewatering Mobilization and Demobilization Equipment and Personnel Downtime	167,000
Indirect Costs Site Facility Costs Stauffer Engineering & Research Personnel Outside Analytical Contractors	173,000
Sub-Total	$ 1,657,000
Contingency and Escalation	663,000
CAPITAL COST	$ 2,320,000

OPERATING AND MAINTENANCE COSTS VENT GAS HANDLING

Supplies		
Electricity		$ 5,000
Blower 5HP	3.7 KW	
Lighting and Instr. Requirements	1.0	
	4.7 KW/HR @ .12/KWH	
Maintenance		3,000
Capital Costs of Blower System is $50,000		
Assume Maintenance @ 5% ($60,000 x 5%)		
Operation and Supervision		
Included with Operating Costs of Groundwater Treatment		-
	Sub Total	**$ 8,000**
Contingency		2,500
TOTAL OPERATING AND MAINTENANCE COSTS		$10,500

TABLE 49

OPERATING AND MAINTENANCE COSTS ACTIVATED CARBON SYSTEM

IVP Carbon with Na Ott Onsite Regeneration

Supplies Assume Replacement of Carbon Every Five Years 12,000# @ $2.70/# = $\frac{\$32,400}{5}$ =	$ 6,000
Regeneration Soak Carbon in Dilute Na Ott for 24 Hours $600/Day for Truck Rental $500 for 300 Gal. Na Ott $300 for Acid 2 Men for 3 Days @ $25/Hr	$ 4,000
Electricity	-
Maintenance Capital Costs of Carbon Adsorption System is $81,000 Assume Maintenance @ 5% ($81,000 x 5%)	4,000
Operation and Supervision Included with Operating Costs of Groundwater Treatment	-
Sub Total	**$14,000**
Contingency	4,000
TOTAL OPERATING AND MAINTENANCE COSTS	**$18,000**

TABLE 50

OPERATING AND MAINTENANCE COSTS THERMAL OXIDATION

Supplies 1.5 Gal. of Propane per hour @ $1.90 Gal.	$20,000
Electrical Assume majority of electric costs will be with Blower System, therefore allow for minor electric costs	1,000
Maintenance Use E. Stocker 3/6/85 Flare Estimate of $132,000 Capital Assume 5% of Capital ($132,000 x 5%)	7,000
Operation and Supervision Included with operating costs of Groundwater Treatment	- 0 -
Sub Total	**$28,000**
Contingency	8,000
TOTAL OPERATING AND MAINTENANCE COSTS	**$36,000**

TABLE 5

OPERATING AND MAINTENANCE COSTS VENT GAS HANDLING

Supplies		
Electricity		$ 5,000
Blower 5HP	3.7 KW	
Lighting and Instr. Requirements	1.0	
	4.7 KW/HR @ .12/KWH	
Maintenance		3,000
Capital Costs of Blower System is $50,000		
Assume Maintenance @ 5% ($60,000 x 5%)		
Operation and Supervision		
Included with Operating Costs of Groundwater Treatment		-
Sub Total		**$ 8,000**
Contingency		2,500
TOTAL OPERATING AND MAINTENANCE COSTS		**$10,500**

TABLE 49

OPERATING AND MAINTENANCE COSTS ACTIVATED CARBON SYSTEM

IVP Carbon with Na Ott Onsite Regeneration

Supplies Assume Replacement of Carbon Every Five Years 12,000# @ $2.70/# = $\frac{\$32,400}{5}$ =	$ 6,000
Regeneration Soak Carbon in Dilute Na Ott for 24 Hours $600/Day for Truck Rental $500 for 300 Gal. Na Ott $300 for Acid 2 Men for 3 Days @ $25/Hr	$ 4,000
Electricity	-
Maintenance Capital Costs of Carbon Adsorption System is $81,000 Assume Maintenance @ 5% ($81,000 x 5%)	4,000
Operation and Supervision Included with Operating Costs of Groundwater Treatment	-
Sub Total	**$14,000**
Contingency	4,000
TOTAL OPERATING AND MAINTENANCE COSTS	**$18,000**

TABLE 50

OPERATING AND MAINTENANCE COSTS THERMAL OXIDATION

Supplies 1.5 Gal. of Propane per hour @ $1.90 Gal.	$20,000
Electrical Assume majority of electric costs will be with Blower System, therefore allow for minor electric costs	1,000
Maintenance Use E. Stocker 3/6/85 Flare Estimate of $132,000 Capital Assume 5% of Capital ($132,000 x 5%)	7,000
Operation and Supervision Included with operating costs of Groundwater Treatment	- -
Sub Total	**$28,000**
Contingency	8,000
TOTAL OPERATING AND MAINTENANCE COSTS	**$36,000**

TABLE 5

Summary of Alternatives, Capital, O & M and Present Worth Costs

ALTERNATIVE	CAPITAL COST	STAUFFER'S O&M	STAUFFER'S PRESENT WORTH	EPA'S O&M	# OF YRS.	PRESENT WORTH 4%	PRESENT WORTH 7%	PRESENT WORTH 10%
GW-1	$0	$45,000	$472,222	$90,000	15	$1,000,620	$819,720	$584,540
					30	$1,556,280	$1,116,810	$846,430
					INF	$2,250,000	$1,285,740	$900,000
GW-2	$750,000	$140,000	$930,000	$230,000	15	$3,347,140	$2,884,840	$2,535,350
					30	$4,757,160	$3,644,070	$2,956,210
					INF	$6,540,000	$4,075,780	$3,050,000
GW-3	$1,250,000	$225,000	$3,610,000	$315,000	15	$4,752,170	$4,115,020	$3,645,890
					30	$6,695,980	$5,156,535	$4,219,505
					INF	$9,125,000	$5,750,090	$4,400,000
GW-4	$4,500,000	$615,000	$10,953,631	$705,000	15	$12,338,190	$10,521,140	$9,868,230
					30	$16,690,850	$13,246,345	$11,146,035
					INF	$22,125,000	$14,571,630	$11,550,000
S-1	$0	$45,000	$472,222	$90,000	15	$1,000,620	$819,720	$654,540
					30	$1,556,280	$1,116,810	$843,430
					INF	$2,250,000	$1,265,740	$900,000
S-2	$22,650,000	$90,000	$23,600,000	$135,000	15	$24,150,530	$23,675,580	$23,676,810
					30	$24,984,420	$24,325,215	$23,922,645
					INF	$26,025,000	$24,578,610	$24,000,000
S-3	$12,300,000	$90,000	$13,250,000	$135,000	15	$13,800,930	$13,525,580	$13,326,810
					30	$14,634,420	$13,575,215	$13,572,645
					INF	$15,675,000	$14,288,610	$13,650,000
S-4	$8,180,000	$90,000	$9,130,000	$135,000	15	$9,680,930	$9,405,580	$9,206,810
					30	$10,514,420	$9,855,215	$9,452,645
					INF	$11,555,000	$10,108,610	$9,530,000
S-5	$11,430,000	$90,000	$12,380,000	$135,000	15	$12,930,930	$12,655,580	$12,456,810
					30	$13,764,420	$13,105,215	$12,702,645
					INF	$14,805,000	$13,358,610	$12,780,000
S-6	$4,050,000	$90,000	$5,000,000	$135,000	15	$5,550,930	$5,273,580	$5,076,810
					30	$6,384,420	$5,725,215	$5,322,645
					INF	$7,425,000	$5,978,610	$5,400,000
S-7	$78,980,000	$90,000	$79,930,000	$135,000	15	$80,480,930	$80,203,580	$80,006,810
					30	$81,314,420	$80,555,215	$80,252,645
					INF	$82,355,000	$80,908,610	$80,330,000
S-8	$17,940,000	$90,000	$18,890,000	$135,000	15	$19,440,930	$19,169,580	$18,966,810
					30	$20,274,420	$19,615,215	$19,212,645
					INF	$21,315,000	$19,868,610	$15,290,000
S-9	$8,960,000	$90,000	$9,930,000	$135,000	15	$10,480,930	$10,209,580	$10,006,810
					30	$11,314,420	$10,655,215	$10,252,645
					INF	$12,355,000	$10,906,610	$10,330,000
S-10	$2,320,000	$90,000	$3,270,000	$135,000	15	$3,820,930	$3,545,580	$3,346,810

TABLE 52

Summary of Alternatives, Capital, O & M and Present Worth Costs cont'd

ALTERNATIVE	CAPITAL COST	STAUFFER'S O&M	STAUFFER'S PRESENT WORTH	EPA'S O&M	# OF YRS	PRESENT WORTH 4%	PRESENT WORTH 7%	PRESENT WORTH 10%
					30	$4,654,420	$3,995,215	$3,592,645
					INF	$5,695,000	$4,246,610	$3,670,000
S-11	$5,270,000	$90,000	$6,220,000	$135.000	15	$6,770,930	$6,499,580	$6,256,810
					30	$7,604,420	$6,945,215	$6,542,645
					INF	$8,645.000	$7,196,610	$6,620,000
S-12	$2,980,000	$90,000	$3,930,000	$135,000	15	$4,460,930	$4,209,580	$4,006,810
					30	$5,314,420	$4,655,215	$4,252,645
					INF	$6,355,000	$4,906,610	$4,330,000
S-13	$205,680,000	$0	$205,680,000	$0	15	$205,680,000	$205,680,000	$205,680,000
					30	$205,680,000	$205,680,000	$205,680,000
					INF	$205,680,000	$205,680,000	$205,680,000
A-1	$0	$0	$0	$16,100	15	$201,236	$164,855	$137,669
					30	$312,985	$224,603	$170,529
					INF	$452,500	$258,577	$181,000
A-2	$1,860,000	$0	$1,860,000	$16,100	15	$2,061,236	$2,024,855	$1,997,669
					30	$2,172,985	$2,084,603	$2,030,529
					INF	$2,312,500	$2,118,577	$2,041,000
A-3	$2,360,000	$28,500	$2,660,000	$46,600	15	$2,876,099	$2,764,433	$2,714,440
					30	$3,165,807	$2,932,259	$2,799,298
					INF	$3,525,000	$3,025,726	$2,826,000
A-4	$2,555,000	$64,100	$3,055,000	$64,600	15	$3,273,223	$3,143,377	$3,046,348
					30	$3,572,063	$3,256,621	$3,163,954
					INF	$4,170,000	$3,477,676	$3,201,000
A-5	$15,510,000	$28,500	$15,910,000	$16,000	15	$15,710,124	$15,673,944	$15,646,908
					30	$15,821,255	$15,733,383	$15,673,688
					INF	$15,960,000	$15,767,148	$15,690,000
A-6	$35,860,000	$0	$35,860,000	$0	15	$35,860,000	$35,860,000	$35,860,000
					$30	$35,860,000	$35,860,000	$35,860,000
					INF	$35,860,000	$35,860,000	$35,860,000

TABLE 52 cont'd

APPENDIX A

RESPONSIVENESS SUMMARY

INDUSTRI-PLEX SITE

Woburn, Massachusetts

September 1986

INDUSTRI-PLEX, WOBURN, MASSACHUSETTS
DRAFT RESPONSIVENESS SUMMARY

This community relations responsiveness summary for the Industri-plex site in Woburn, Massachusetts, is divided into the following sections:

I. Overview - This section summarizes the cleanup alternative recommended by Stauffer Chemical Company for remedial action at the Industri-plex site, and summarizes briefly public support for that alternative. Comments from potentially responsible parties are also summarized.

II. Background on Community Involvement and Concern - This section provides a brief history of community interest and concern regarding the Site.

III. Summary of Major Comments Received during the Twelve Week Public Comment Period and EPA Responses to the Comments - This section categorizes both written and oral comments by the community; local, state and federal officials; and potentially responsible parties on the proposed cleanup approach. EPA responses to these comments are also provided.

IV. Remaining Concerns - This section describes community concerns raised during the twelve week public comment period that EPA and the State should be aware of as they prepare to undertake remedial design and remedial action at the Industri-plex site.

In addition to the above sections, Attachment A, included as part of the responsiveness summary, identifies the community relations activities conducted by EPA during remedial response activities at the Industri-plex site.

I. OVERVIEW

The Cleanup Alternative

The draft feasibility study (FS) for the Industri-plex site, which examines the feasibility of various cleanup alternatives, was prepared for EPA by Stauffer Chemical Company. The FS recommends a remedial alternative that involves several separate actions designed to treat groundwater contamination, treat odors resulting from hide piles, and treat contaminated soils.

Stauffer's proposed treatment of groundwater would involve pumping all the groundwater that leaves the Site at the Site boundary, treating the groundwater with an air stripping process to ensure compliance with EPA criteria for drinking water, and discharging the treated groundwater to nearby Hall's Brook. This option will remove 99.9 percent of the benzene from the treated water before the water is discharged. The remaining contamination in the groundwater will disperse naturally in the underlying aquifer to a level three times lower than EPA drinking water standards.

Stauffer's proposed method of treating odors from hide piles would involve: a) lowering the water table around the East and West piles to reduce odor associated with wet hides; b) stabilizing and grading the sides and top of the East Pile, covering it with a twelve inch layer of gravel, a synthetic cover to prevent rain water from getting into the pile and prevent gases from escaping without first being treated, and twenty-four inches of soil; and c) installing a gas ventilation and collection system in the East Hide Pile to capture and treat gases created from the decay of wastes in the pile before releasing them into the air.

Stauffer's proposed method of treating contaminated soils would involve covering 43 acres of the most highly contaminated soil with thirty inches of soil and vegetation. About 200,000 cubic yards of soil are estimated to be necessary for this. The soil would be delivered in trucks to the Site over the course of about one year.

Public Support for the Cleanup Alternative

Contaminated Soils: The CAC reported that it was not prepared to state a preferred alternative for treatment of contaminated soil and that two alternatives seem to have merit: 1) treating the soils where they have been found, and 2) excavating and consolidating the soils into one smaller area. With regard to treatment of contaminated soils, the North Suburban Chamber of Commerce and U.S. Representative Edward Markey prefer an action involving excavation and consolidation of soils, and relocation to other on-site locations.

The CAC, community members, the Chamber of Commerce, and local officials all expressed a great deal of concern regarding the long-term monitoring, maintenance, and use of the Industri-plex site.

Odors Resulting from Hide Piles: The comments received during the public comment period indicate that the Industri-plex Citizens' Advisory Committee (CAC), the North Suburban Chamber of Commerce, interested members of the community, and U.S. Representative Edward Markey concur with the proposed treatment of hide deposits.

Groundwater Contamination: Members of the Industri-plex CAC and members of the community also support the proposed treatment of groundwater contamination. The Water-Soil Subcommittee of the CAC suggests that treated groundwater be recharged upgradient into the aquifer rather than discharging it into Hall's Brook, as preferred by Stauffer. U.S. Representative Edward Markey prefers treating the water downgradient of the Site in an effort to reduce the pollutants released into surface water.

Comments from Potentially Responsible Parties

The Monsanto Company, a potentially responsible party, stated that the preferred alternative adequately addresses public health and environmental issues. The company elaborated on the preferred alternatives for treatment of hide piles and contaminated soils. The company presented a new approacch to groundwater treatment which would involve pumping downgradient, off-site groundwater to a biological treatment system and reinjecting the effluent upgradient of the well system.

Section III below provides a more detailed discussion of individual preferences concerning the proposed cleanup approaches.

II. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERN

Community awareness of what is now known as the Industri-plex site goes back to 1863 when the Massachusetts Department of Public Health first conducted hydrogen sulfide testing in response to public complaints of odors emanating from the Site area. The Site was used for manufacturing chemicals and later for manufacturing glue which involved cooking animal hides to extract the glue. For nearly a century, the methane and hydrogen sulfide gases causing the "Woburn odor" were considered to be a public nuisance. Residents also claimed that the area was unsightly and was responsible for various health ailments.

In 1979, Site preparation for an industrial park revealed the presence of a variety of chemical wastes from industrial activities. At this time, the Massachusetts Department of Environmental Quality Engineering (DEQE) and the EPA began to investigate the Site actively. On April 23, 1980 in accordance with the Massachusetts Environmental Policy Act, the Massachusetts

Secretary of Environmental Affairs authorized the formation of a Citizens' Advisory Committee (CAC) to provide input to and review technical documents related to the Site.

As a result of this, a 14-member CAC was formed. Members included representatives from the cities of Woburn, Wilmington, Winchester, and Reading, as well as representatives from local ad hoc environmental groups. For the first three years of its existence, the CAC met on a weekly basis for the purpose of highlighting and attempting to resolve issues of community concern related to the Site. Non-voting representatives of EPA, DEOE, and the U.S. Army Corps of Engineers also attended the CAC meetings. After the CAC had been in existence for a few years, the North Suburban Chamber of Commerce and an area branch of the League of Women Voters also joined the CAC as voting members.

From 1983 to date, the CAC has met less frequently but has continued to provide substantial input to the Superfund cleanup process. The potentially responsible party conducting the RI/FS at the Site has actively cooperated with the group and has incorporated many CAC suggestions into the RI/FS.

The City of Woburn, surrounding communities, and the North Suburban Chamber of Commerce are all interested in promoting industrial development in an effort to stimulate the regional economy. However, a federal consent decree has been issued requiring cleanup of the Site before any development can take place. The City of Woburn and the Chamber of Commerce are concerned that the cleanup is taking too long and hindering the process of development. Several residents and the Citizens' Advisory Committee would prefer that the Site never be developed because hazardous wastes have been identified on-site. The Site development issue is one of serious community concern.

III. SUMMARY OF MAJOR COMMENTS RECEIVED DURING THE TWELVE WEEK PUBLIC COMMENT PERIOD AND EPA RESPONSES TO THE COMMENTS

Comments raised during the Industri-plex site public comment period are summarized briefly below. The comment period was held from May 14, 1985 to August 1, 1985 to receive comments from the public on th draft feasibility study. Comments are categorized by type of commentor, (e.g., the community, local officals, and potential responsible parties) and topic.

Comments from the Community

Each of the major community groups at Industri-plex expressed its preferences and concerns with the proposed remedial actions. Their comments are summarized below.

Treatment of Groundwater Contamination

Stauffer's proposed treatment of groundwater would involve pumping all the groundwater that leaves the Site at the Site boundary, treating the groundwater with an air stripping process to ensure compliance with EPA criteria for drinking water, and discharging the treated groundwater to nearby Hall's Brook. Nearly all of the contaminants in the groundwater will be removed by the air stripping process. The remaining contamination in the groundwater will disperse naturally into the aquifer underlying the Site.

1. The Industri-plex CAC, with the exception of the Water-Soil Subcommittee, endorsed the proposed treatment of groundwater contamination but requested that a monitoring and maintenance program be implemented to ensure that the air stripping system operates reliably and that malfunctions are detected quickly.

EPA Response:

A major component of any remedial action selected by EPA would be the development and implementation of a plan for monitoring and maintaining the efficiency of the remedial action. This plan is broken into two sections. The first section deals with designing and implementing a monitoring network to effectively evaluate the remedial action. This would include determining the number and location of monitoring wells to detect the effectiveness of the recovery wells. It would also include determining sampling locations throughout the treatment system to ensure that the system is operating as designed and to provide an early warning mechanism when and if a portion of the treatment system breaks down. The second portion of the plan deals with identifying areas within the remedial action that will require periodic or routine maintenance and to plan a course of action to provide that maintenance. Included in the costs are plant operator salaries. These plans are required for all remedial actions prior to their implementation.

2. The Water-Soil Subcommittee of the Industri-plex CAC differed from the majority of the CAC and requested a more detailed explanation as to why remedial Option I (pump "hot spots," air strip, recharge upgradient into aquifer) is unacceptable. The Subcommittee believes that the preferred Option II (intercept plume at Site boundary, air strip, discharge into Hall's Brook) may be overly-protective and expensive.

EPA Response:

The Agency agrees in part with the Water-Soil Subcommittee and selected Option I (alternative GW-2 in Record of Decision) as an interim remedy instead of Stauffer's proposed Option II (GW-3 in Record of Decision). In the FS, Stauffer recommended the selection of GW-3 because they believed that it was the most cost effective alternative which is protective of the public health, welfare and environment and met applicable or relevant and appropriate federal public health and environmental requirements. As a final long term decision the Agency would have to weigh very carefully alternatives GW-3 and GW-4 in order to make the same decision recommended by Stauffer. However, the Agency believes that, based on its knowledge of other existing and potential groundwater problems within the aquifer, it is not cost effective and it is inappropriate to make a final decision about on-site remediation without ensuring that it is consistent with the larger regional aquifer decision; hence the selection of GW-2. The pump and treatment of the "hot spot" areas will remove approximately eighty percent of the contaminants within six to nine months. The Agency believes that as an interim remedy the implementation of GW-2 is cost effective when compared to GW-3 which would remove an additional ten percent of the contaminants at a substantially increased cost and timeframe (10 years).

3. The North Suburban Chamber of Commerce proposed that contaminated groundwater detected in one off-site well (OW-17) be pumped and piped to the proposed treatment plant.

EPA Response:

The North Suburban Chamber of Commerce's proposed pumping of only one off-site well (OW-17) would be a modified version of GW-4, the most expensive alternative considered. The Agency believes that this alternative is neither cost effective nor capable of providing a significant increase in protection. The pumping of one well would not be capable of capturing all of the contaminants migrating off-site. The aquifer becomes significantly deeper and wider as it gets further downgradient of the Site boundary. As a result, the saturated thickness of water necessary to intercept the plume effectively becomes much larger and requires more wells or extraction capacity than the interception of groundwater at the Site boundary. Therefore, the pumping of one off-site well would not be practical or effective. Stated another way, this alternative is much more costly for only a marginal gain in protection.

In addition to the above reasons, the Agency has determined that the groundwater problems associated with the Site should be dealt with as an area-wide groundwater problem. As a result, the Agency will implement an interim remedy pending a final decision on the long term remedial action for the larger area-wide problem.

4. The Mystic River Watershed Association and the Industri-plex CAC suggested that the aquifer underlying the Site be rehabilitated for future use in private industrial processes and that some government authority be given responsibility for monitoring and sampling water quality.

EPA Response:

The aquifer underlying and downgradient of the Site is currently being used by several industries in the area. The water is being used as non-contact cooling water for air conditioning purposes. The volumes required for this purpose are not large; given the current and potential uses of the buildings within the area, it does not appear that there is a significant demand for large quantities of industrial process water. Therefore, the Agency questions the need to address this specfiic issue as part of the Record of Decision (ROD).

The issue of the long term uses and degree of cleanup within the aquifer will be resolved as part of the proposed Multiple Source Groundwater Response Plan (MSGWRP) outlined in the ROD. This MSGWRP is designed to address the potential impacts on the aquifer, determine the long term needs for the aquifer and how to obtain these goals in light of current Agency guidance and policies. Specifically, the answer to the question will be addressed as part of the MSGWRP.

5. Dundee Park Properties, an owner of land adjacent to the Site, is concerned that the Stauffer study has ignored data from a July 1982 study which indicated elevated levels of benzene and toluene in wells on Dundee Park property within the East and West Hide Pile. Dundee Park Properties and its engineering consultants anticipate that a number of areas within these piles may exceed the criteria which Stauffer used to define contaminated soil areas.

EPA Response:

The RI/FS evaluated the impacts to the groundwater resulting from the Site. The RI determined that the source of benzene and toluene originates much further south than the East Hide Pile. The RI did not detect any impact resulting from benzene or toluene in the hide pile. The RI determined that the shallow pond adjacent to the Dundee Park wells was a discharge zone for the local groundwater. As a result, the elevated level detected in the Dundee Park wells would most likely discharge to the pond. Water quality sampling within and downgradient of the pond did not detect the presence of these volatile organic compounds.

The recommended remedial action for the East and West hide Piles will address all areas mentioned in Dundee Park's comments. Specifically, the piles will be capped to minimize any additional leaching of material from the piles.

6. A community member suggested that no work be done at the Site until the Wells G and H Site in Woburn, Massachusetts had been tested for radiation; if any radiation is found, its source should be identified.

EPA Response:

The Wells G and H Site, located in East Woburn, is a separate and discrete site currently listed on the National Priorities List (NPL) which is undergoing a separate remedial investigation/ feasibility study to determine the nature and extent of contamination. While there exists a relationship between the two sites as a result of the Industri-plex 128 site being upgradient hydrologically from the Wells G and H site, the Agency believes that the issues relating to Wells G and H are most appropriately addressed during that investigation and not here.

In the Record of Decision the Agency has selected an interim groundwater remedy for the Industri-plex site. This decision to partially remediate the groundwater problems resulting from the Site was based on the knowledge of actual or potential groundwater impacts abutting the Site. Prior to selecting a permanent long term remedy, the Agency decided that the implementation of a Multiple Source Ground Water Response Plan (MSGWRP) to adequately address these other problems was the most efficient method to decide on the long term clean-up goals for that portion of the aquifer. This MSGWRP will address the general area around the Site and is not expected to specifically encompass Wells G and H, except in light of the potential impacts to Wells G and H from the decisions made relative to the MSGWRP study area.

Proposed Remedial Actions

7. U.S. Representative Markey stated serious doubts as to whether the recommended method of removing benzene and toluene from groundwater will ensure that contaminated water is not endangering public health. As an alternative to the recommended method, Markey proposed treating the water downgradient of the Site and monitoring treated groundwater at its point of introduction into surface water. Markey also requested that Hall's Brook be tested regularly to ensure that contaminants are not being discharged from the Site.

EPA Response

The Agency evaluated the various options for remediation of the contaminated groundwater. As described in the Record of Decision (ROD), the Agency choose to implement an interim remedial action while resolving the more widespread contamination or threat of contamination surrounding the Site. The Agency chose to implement an interim solution based on a number of factors which are detailed in the ROD. One of the primary reasons behind selection of an interim remedy was the belief that the public health, welfare and environment would not be impacted adversely during the period of time the regulatory agencies were designing a comprehensive cleanup plan for the groundwater. It should be noted that currently no one is consuming water from the aquifer; in fact, the industrial uses are relatively limited as well.

The monitoring of Hall's Brook will be considered as part of the investigation during the Multiple Source Groundwater Response Plan.

Treatment of Odors Resulting from Hide Piles

Stauffer's proposed method of treating odors from hide piles would involve: a) lowering the watertable around the East and West Piles to reduce odor associated with wet hides; b) stabilizing and grading the sides and top of the East Pile, covering it with a twelve inch layer of gravel and a synthetic cover to prevent rain water from getting into the piles and to prevent gases from escaping without first being treated, and then covering this with twenty-four inches of soil; and c) installing a gas ventilation and collection system in the East Hide Pile to capture and treat gases created from the decay of wastes in the pile before releasing them into the air.

8. Industri-plex CAC concurs with the proposed treatment of hide deposits, but believes that the test period for evaluating alternative collection and treatment systems should be longer than the seven weeks proposed by Stauffer to ensure reliability and suitability in various weather conditions and throughout four seasons. The CAC also wants to ensure that the system design will prevent adverse environmental impact should the system malfunction and suggested that back-up systems be used to minimize that possibility.

EPA Response:

EPA agrees with the CAC regarding the length of the monitoring period for determining what type of treatment, carbon adsorption or incineration, is appropriate for the East Hide Pile. EPA intends to monitor the volume and composition of the gases collected for a period of one year following the installation of the gas collection system and the cap on the hide pile. While this will delay the final solution of the "Woburn odor" problem, it will help ensure that the solution achieves its goals.

EPA also concurs with the CAC's concerns regarding the impact of malfunctions on the public and the environment. An essential element of a successful remedial action is ensuring that the action is well designed and constructed so that malfunctions are minimized. Equally essential is providing back-up on critical components of the system. For the incineration option, for instance, there will be two flame ignition systems and interlocking control devices to ensure that no gases from the hide pile enter the incinerator if there is no flame. These safety and back-up equipment specifications will be addressed during remedial design.

9. The Industri-plex CAC urged that EPA evaluate the benefits and problems of the proposal for using soil from the South Hide Pile to stabilize the East Hide Pile. The group is concerned that this action may release undesirable odors.

EPA Response:

The South Hide Pile is a comparatively small pile of wastes that contains some hide material. The RI indicates that only small deposits of glue manufacturing wastes are present in this pile. The test pits, borings logs and the personal experience of the field personnel conducting and supervising these activities indicate that the odor potential is low. The pile is bordered on two sides by developed properties and a portion of the drainage channel that will be needed to redirect the water from the pond between the East and West Hide Piles to the Hall's Brook storage area. The third side of the pile abuts an active railroad siding. Given these tight quarters, it would be extremely difficult to cap this pile in place without relocating the siding, the drainage channel and a portion of at least one building.

EPA believes that relocating this pile is the most practicable means of isolating it from the environment and public. EPA recognizes, however, that the potential exists for generating odors during the relocation. EPA does not believe that significant odors will be generated, but if they are, EPA will halt the relocation, reassess the size of the problem and develop a plan for dealing with the problem. The plan will be reviewed with the affected community. If the reassessment of the problem indicates, as currently believed, that the amount of hide material is small, work practices could be instituted that could minimize the intensity and duration of the odors. In this case, consulting with the community would be aimed at gauging to what extent it is willing to endure short-term odors in return for a long-term solution to the problem.

If the amount of hide material is large the Agency would have to reassess its decision and would likely cap the pile in place using sheet piling or other methods to protect the developed properties abutting the pile until such time as adequate equipment can be mobilized to complete the job as fast as possible while ensuring that odorous materials are limed and covered in transit. Additionally, relocating odorous materials will be accomplished between 9 a.m. and 4 p.m. only and all materials will be covered daily.

10. A community member proposed that the hide piles be covered with soil, rather than capped with a synthetic cover, and allowed to aerate and decompose naturally.

EPA Response:

As evidenced in the Arthur D. Little odor specialist's report, capping of the west and central hide piles has eliminated odor emissions from these potential sources. Therefore, the community member's proposal has merit. Capping the East Hide Pile in itself might work. EPA is not convinced, however, that it will. EPA prefers to have the added assurance of trapping, collecting and treating the gases. If EPA approved this citizen's proposal and it proved ineffective, retrofitting the pile with the systems described in the ROD would be very expensive.

If, on the other hand, the systems are installed as described in the ROD and the volume of gas generated by this pile drops to the point where treatment proves unnecessary, then the collection system can be sealed and the treatment system shut off.

11. The Industi-plex CAC urged EPA to seriously question Stauffer's use of "limiting effect dose" levels (LEDs) as a measure of the release of odor because much lower levels than the specified LEDs would still be objectionable to the CAC. In addition, the CAC requested that further consideration and substantiation of appropriate concentration levels of contaminants be undertaken. They suggested that more than one set of limiting effect dose levels may be necessary since there are several distinctly different populations at risk in the area. For example, workers in a nearby building may be exposed to contaminants during a normal work day whereas residents some distance away from the Site may be exposed over a longer period of time.

EPA Response:

The FS did not use "limiting effect doses" (LEDs) to calculate the level of hydrogen sulfide and other reduced sulfur compounds at which the community would experience "objectionable odors". The LEDs were used to calculate the level below which there would be no health problems experienced by the community.

All decisions as to the level at which objectionable odors would be detectable are based on the data provided by the trained Odor Panel from Arthur D. Little, Inc. (ADL), respected authorities on odors and their perception. The ADL Odor Panel conducted surveys in field measurements and laboratory evaluations in support of their findings.

Based on ADL's findings Stauffer calculated the worst case odor levels based on either taking no action or implementing the carbon adsorption remedial action. With carbon adsorption, no detectable odors are anticipated based on Stauffer's air modelling.

In response to the comment suggesting that multiple LEDs may be needed for each contaminant in order to evaluate the impacts on the health of nearby workers as compared to residents some distance from the Site, the FS points out that for a given contaminant there is a lowest dose at which a toxic effect was noted. By definition, there can be only one LED for a given chemical. What Stauffer did to address the CAC's comment was to postulate several exposure scenarios, both on-site and off-site, to address the various routes by which the public could be exposed to these chemicals. The Agency for Toxic Substances and Disease Registry (ATSDR) has reviewed these scenarios and considers them "worst case" exposures.

12. A community member requested that, at the Industri-plex site and in future work, EPA, rather than claim that hydrogen sulfide odor is not a health hazard, instead state that it is currently not known if hydrogen sulfide odor is a health hazard.

<ins>EPA Response</ins>:

The EPA does not now consider hydrogen sulfide odor a hazardous waste or hazardous substance. All of EPA's decisions on the hazards posed by chemicals are based on the latest reliable data. As in all cases, it is possible that new data will cause the Agency to re-evaluate the levels at which a chemical poses a problem. Thus, new information may arise that will force a re-evaluation of the Agency's opinion of the hazards posed by hydrogen sulfide. On the other hand, hydrogen sulfide is a common chemical, has been a factor in the workplace of numerous occupations and industries (notably petroleum refining and waste water collection and treatment) for a long time, and hence has a large data base on which EPA can base its assessment of the hazard posed.

13. Dundee Park Properties, an owner of land adjacent to the Site, agreed with the proposed remedial action for the East Hide Pile but requested that Stauffer take responsibility for covering <ins>all</ins> the hide piles on-site, not just the East Pile. The company requested that the East and West Piles be graded back from their property and that the displaced material be placed on the central or South Hide Piles and covered. The company also recommended that the soil area along the west side of the south pond be covered by thirty inches of soil and vegetation.

<ins>EPA Response</ins>:

The remedial action for the West Hide Pile, as well as the remaining deposits containing animal hide material, is to cover these areas with the 30-inch soil cover described in the S-11 alternative. The East Hide Pile will receive a separate remedial action. The purpose of covering the remaining hide deposits is the same as that for contaminated soils, which is to eliminate the potential for direct contact. In addition, the additional fill material will further reduce the odor potential.

In response to the second part of Dundee Park's question, the Agency believes that grading or removing significant portions of the East or West Hide Piles cannot be performed without creating a substantial odor problem. The Agency does not believe it is necessary or prudent to remove these deposits in order to implement an effective remedial action.

The Agency recognizes that there are exposed waste deposits along the west, south and east margins of the pond. These deposits will be addressed by the remedial action for contaminated soils and sludges. They will either be removed from the wetland or stream and capped or, in instances where excavation is not practicable, the streams will be isolated from the wastes by installing culverts.

14. The Industri-plex CAC requested that it be stated clearly that the gas collection/treatment program is intended to respond to any odors which may later develop in the West Hide Pile (which is not slated for treatment). The CAC states that such odor sources must be eliminated should they develop.

EPA Response:

The Agency is sympathetic to the concern articulated by the CAC that odors emanating from the Site be eliminated, regardless of the source. The data collected during the RI, including the results of the Arthur D. Little Odor Panel, indicate that the East Hide Pile is currently the only source of odors. Based on this determination, the Record of Decision (ROD) concluded that only the East Hide Pile required collection and treatment for the elimination of odors.

The Agency believes that controlling odor emissions from the East Hide Pile will protect the public health, welfare and environment and will restore the public's ability to enjoy the use of their property and to conduct their normal business. In addition, the Agency believes that by placing additional soil cover and institutional controls on the remaining hide deposits the potential for the release of odors is minimal. However, in the event that a remedial action is not effective or Site conditions change so that there is a release or threat of release, the Agency will revisit the problem and take appropriate actions to minimize or eliminate the threat.

15. U.S. Representative Markey agreed with Stauffer's proposal for treating odors from the hide piles but recommended that the discharged gas be monitored closely to ensure that it has been treated properly.

EPA Response:

The Agency will, as part of the Remedial Design process, develop and approve a comprehensive sampling and analysis plan for the air remedial action. This plan will not only document the efficiency of the treatment system but that the public health, welfare and environment are protected as well.

16. The Reading Board of Health had many concerns regarding the proposed remedial alternative for the hide piles. Specifically, the Board requested that: a) more consistent data be provided as to the toxicity of hydrogen sulfide and other potentially toxic substances; b) air monitoring stations be installed on-site and downwind (in Reading) during cleanup to provide data on hydrogen sulfide, toluene, benzene, other gases and particulate matter; and c) a contingency plan be developed, with Reading officials, to address treatment system malfunctions and measures for temporary relocation of residents with health problems.

EPA Response:

a) The amount of health effects or toxicity data for a specific chemical varies widely and is very compound specific. For hydrogen sulfide (H_2S) the available data indicates that H_2S is primarily a respiratory irritant. H_2S is a naturally occurring gas, the result of decomposition and typically found in dumps, swamps, sewer gases and natural gas. In high concentrations of 500-1000 parts per million (ppm), H_2S acts as a systemic poison, potentially causing unconsciousness and death. H_2S is heavier than air and will displace air in low lying or confined areas. At lower concentrations (less than 100 ppm) it tends to be a respiratory irritant and affects the eyes. For additional information on this compound and others found at the Site, the reader is referred to Appendix G of the FS.

b) The use of ambient air quality stations during the implementation of the remedial action will be considered as part of the remedial design process. However it is important to point out that the detection of the compounds of concern using ambient monitoring techniques is very difficult, if not impossible at the expected concentrations. Instead the Agency intends to use industrial hygiene monitoring and closein monitoring to protect worker safety and to quickly detect and prevent any release from emanating off-site.

To illustrate the above noted point, H_2S can be detected by the average individual at concentrations far lower than typically used analytical field instruments. As a result, a field inspector using this instrumentation will report none detected even through he or she may clearly smell the H_2S odor.

Therefore, it is important and practical to use construction techniques which minimize the generation of odors in the first place and then try to contain these odors on-site as much as possible.

c) As noted in a previous answer, the Agency intends to work closely with all interested parties to ensure that the implementation of the remedial action will not adversely impact the surrounding communities. The Agency will work with the CAC, local public health agencies, affected businesses and the general public to ensure that their concerns are addressed and incorporated to the extent practicable as the remedial design progresses.

17. The Reading Board of Health requested that: a) ample notification be given to the Board and other town officials regarding the construction and cleanup timetables, with specific dates when odors would predictably be strong and emission levels high; and b) data on the human health effects of hydrogen sulfide and other substances be made available to Reading residents.

EPA Response:

As noted in previous answers, the Agency believes that ample opportunities for input exist during the Remedial Design process. The Agency further believes that the specific answers to the Reading Board of Health will come as a result of the interactions during the design process.

Treatment of Contaminated Soils

Stauffer's proposed method of treating contaminated soils would involve covering 43 acres of the most highly contaminated soil with thirty inches of soil and vegetation. About 200,000 cubic yards of soil would be required for this, and the soil would be delivered to the Site in trucks over the course of about one year.

18. The Industri-plex CAC reported that it was not ready to state its preferred alternative for treatment of contaminated soils. The CAC agreed with the proposal to cover the contaminated soil but wants additional information about the excavation and consolidation alternative and the relative risks of the two options. The CAC had specific questions about the excavation alternative, namely: a) What methods will be used to remove, transport, backfill and consolidate contaminated areas? b) How will dust be minimized? c) How can it be ensured that all contaminated soil has been excavated?

EPA Response:

The Agency considered the consolidation options very thoroughly because they minimized the land area over which institutional controls would be required, reduced the amount of operation, maintenance and monitoring required, and restored presently contaminated land to full utilization. The Agency rejected the consolidation options proposed in the Feasibility Study because they would remove contaminants from undeveloped land only, leaving contaminants on already developed land. The Agency finds this distinction arbitrary.

Further, as proposed in the Feasibility Study, the result of the consolidation would be a capped landfill surrounded by a clean zone which would be, in turn, surrounded by a second, discontinuous contaminated zone. This situation does not add materially to the protection of the public health, welfare or the environment, but does add substantially to the costs of the remedial action.

The Agency cannot spend money from the Fund to aid the economic development of the industrial park. The only justifiable reason for consolidating these wastes is to minimize the accidental or intentional disturbance of the completed remedial actions by minimizing the land area that must be controlled in perpetuity.

Toward this end, a well-defined landfill is preferable to an amorphous collection of deposits. Therefore, if the Agency were to endorse a consolidation option, it would be one in which all outlying deposits were brought to a central location. This means removing contaminants from developed properties as well - including contaminants currently covered by buildings.

The Agency does not believe that the added protection provided by such a measure warrants the very large increase in cost. Since the Agency has not selected a consolidation option, there seems to be no need to discuss in detail the mechanisms by which such a plan would be implemented.

19. The North Suburban Chamber of Commerce disagrees with the proposed remedial action and, instead, prefers the excavation and on-site relocation of contaminated soils. The Chamber recommends capping the soils and then backfilling the excavated areas. The Chamber claimed that the FS did not address the long-term feasibility or reliability of the soil cover and its maintenance at a large industrially active Site.

EPA Response:

The Agency believes that it has adequately addressed the Chamber's concerns in the previous answer.

20. The Industri-plex CAC requested that work should stop immediately if unanticipated pockets of waste are discovered during implementation of the remedial action. This work should not begin again until an appropriate solution is implemented.

EPA Response:

The Agency believes that the nature and extent of the waste problems at this site are reasonably well defined and understood. As part of the remedial design process certain areas will receive additional work to better delineate the actual extent of the waste. This is a normal part of the design process, so that at the end of the remedial design the Agency will know and understand exactly what to expect once construction begins. However, during the actual course of events, situations frequently present themselves to the construction engineer that he or she did not anticipate. If the situation is such that it does not present a particular problem, (i.e., more of the same waste than originally calculated), the engineer makes adjustments and the work proceeds. If, however, the situation is such that work should be stopped until such time that a satisfactory solution to the problem can be worked out, then the engineer will implement the contingency plan outlined in the remedial design to address the problem. The Agency believes that the type and nature of problems which require the use of the contingency plan will receive adequate discussion during the remedial design process. A number of copies of the design and contingency plan will be made available to the appropriate community officials and the public.

21. The Chamber of Commerce and a citizen requested that further soil and surface water sampling be carried out in those areas (both on- and off-site) most likely to be contaminated with highly-toxic hexavalent chromium.

EPA Response:

Additional sampling during the remedial design process will be necessary in order to adequately design the remedial actions. This sampling may include additional surface and groundwater, soil and air sampling. In addition, once the remedial action is completed, an ongoing monitoring program will be implemented to ensure the continued effectiveness of the remedial actions. Further, the RI did not detect any hexavalent chromium.

22. The Mystic River Watershed Association reported that some of its members felt that providing thirty inches of soil cover for the contaminated areas was too much soil.

EPA Response:
The Agency evaluated a number of soil covering alternatives, including the use of a thirty inch cover. The Agency selected the thirty inch cover for several reasons, detailed in the Record of Decision. The primary reasons for thirty inches was to eliminate the effects of the freeze-thaw cycle and to minimize the potential for exposing wastes to erosion. The Agency did note that there may exist alternatives to the use of thirty inches which are effectively equivalent to the recommended alternative. The Agency may, as a result of the design process, select some modified version of the selected alternative so long as the Agency believes that the modified version is equivalent or better than the existing alternative as proposed.

23. A physican from the community proposed that, rather than covering contaminated soils, chemicals should be injected into borings to form a gel blockage around the waste and that the area should be monitored.

EPA Response:

The FS evaluated the feasibility of this alternative as part of the initial screening process. The alternative was eliminated based on costs and technical impracticability for a site of this magnitude. It should be noted that these types of in-situ treatment technologies are innovative processes that have not been field tested extensively. As a result, the usefulness of some of these techniques has been limited to very specific chemicals and Site conditions as well as small and carefully controlled situations. As more experience is gained with these technologies over a wider operating range, their use at sites such as Industri-plex may become routine and cost-effective.

Furthermore, these grout curtain technologies are used in conjunction with, not in place of, covers. A grout curtain will not protect the public against the potential for coming into contact with wastes at the surface of the ground. A cover is required to accomplish this.

24. Dundee Park Properties, an owner of land adjacent to the Site, proposed that waterlines be replaced and contaminated soils removed.

EPA Response:

The FS evaluated the feasibility of excavating contaminated material from around the water, sewer, gas and electric lines, and concluded that it was not necessary as part of these remedial actions. In the course of any emergency or routine maintenance on these utilities, special care must be taken and excavated material must be replaced with clean fill. The Agency, in evaluating the various pros and cons of each option (containment versus complete removal), had to consider the reasons for immediate excavation as opposed to excavation and removal as needed. The Agency ultimately concluded that the costs and benefits associated with immediate removal were not sufficient to warrant such an action. Instead, the Agency proposes to leave the existing utilities intact and implement a strict set of requirements in the event that the utilities are disturbed. Under present conditions, the deposits surrounding the utilities do not pose a threat to the public health, welfare or environment. This determination would not hold true in the event that excavation occurred around the utilities. The direct potential contact would increase significantly as well as the potential for release to the environment as a result of the excavation. However, these issues can be adequately addressed prior to beginning the excavation. The Agency believes that, as part of the remedial design, procedures and associated contingencies can be adequately developed and implemented to address the issue of utility excavation.

25. The North Suburban Chamber of Commerce believes that Stauffer's proposal to cover and leave contaminated soils in place on-site may result in reduced property values for many parcels of land on the Site thereby creating financial hardship for some firms. Therefore, the Chamber prefers that contaminated soils be excavated and relocated to another portion of the Site.

EPA Response:

The North Suburban's Chamber of Commerce concern was evaluated as part of the selection of the remedial alternative. The agency ultimately rejected the consolidation option for several reasons summarized below and detailed throughout the Record of Decision (ROD).

The RI/FS determined that the contaminated sludges and soils only posed a potential for direct contact threat if allowed to remain exposed. If the material was covered to a sufficient depth to eliminate the potential for future exposure resulting from the effects of the freeze-thaw cycle or erosion, then the objectives of the remedial actions would be achieved. The ROD indicated that the existence of structures such as buildings or parking lots were equivalent to thirty inches of clean cover material. As a result, the need to consolidate in order to implement an alternative that was protective of the public health and welfare and the environment was not necessary. As a practical matter even under the consolidation options illustrated in the Feasibility Study (FS) the financial hardship would still exist for the property owners. This is because the Agency has data which indicates that waste material may still be buried under existing buildings, parking lots and roadways. In those instances, removal of the waste material is not practical unless the structure is physically removed to obtain access to the waste. As a result, the waste material is likely to remain buried under the structure. Because the waste material will remain under the structure, this fact will be documented and controlled through the use of institutional controls to prevent its disturbance during any future building modification or like circumstances; hence, the current property has a liability under current federal and state statutes.

26. U.S. Representative Markey believes that Stauffer's proposal to cover forty acres of waste deposits ignores over thirty additional acres of potentially toxic deposits on-site. Markey proposed excavating the waste deposits and then consolidating and disposing them in an on-site secured landfill.

EPA Response:

The Stauffer proposal as outlined in the FS indicates that, based on their calculation, only forty acres of the seventy acres required the application of a soil cover in order to protect the public health, welfare and environment against the potential for direct contact.

The recommended remedial action selected in the Record of Decision (ROD) is consistent with the initial Stauffer recommended alternative. It is important to note that the proposal addresses remedial actions which address the entire Site but that only approximately forty acres would require some additional cover material in order to place the waste deposits below the effects of the freeze-thaw cycle and minimize the effects of erosion. Irrespective of the depth below grade, the ROD requires, as part of the remedial action, that all waste deposits containing any contaminant above the action level have restrictive institutional controls placed on the area. The purpose of these controls is to contain the wastes in place, eliminate the potential for accidental disturbance and control how the wastes will be handled in the future. The Agency believes that this method is equally protective of the public health, welfare and environment as any consolidation alternative and far less disruptive.

27. During the remedial investigation, no suitable analytical method could be identified or developed for accurately measuring the amount of hexavalent chromium in samples containing high levels of trivalent chromium. The North Suburban Chamber of Commerce (NSCC) is concerned that this may have caused hot spots of hexavalent chromium in soils to have gone undetected.

EPA Response

When EPA became aware that the analytical methods used to detect the presence and concentrations of hexavalent chromium in soils were inadequate and producing misleading results, the Agency evaluated alternative methods. Several different methods were employed to overcome the deficiency; however, none produced satisfactory results. As a result, the Agency used an indirect method to determine if hexavalent chromium could be of significant concern at the Site. First, it is important to note that, under conditions typically found in the environment, hexavalent chromium quickly reduces to the less toxic trivalent form of chromium. The other important factor to note is that hexavalent chromium is relatively soluble in water. Hence, if a deposit containing hexavalent chromium were leaking to the groundwater, the presence of the hexavalent chromium would quickly be detected since the analytical problems experienced with analyzing soils are not present for aqueous analysis.

Therefore, if groundwater monitoring wells are located near areas of suspected chromium deposits, they would detect any hexavalent chromium leaking from the soils. Wells OW-12, OW-13, OW-18 and OW-18a were so located and did not detect any hexavalent chromium.

28. The North Suburban Chamber of Commerce is concerned with the reliability of a 30-inch cap as a barrier between the public, specifically construction and maintenance workers, and the waste deposits in the developed areas of the Site. The NSCC feels institutional controls will be an inadequate guarantee that the cover will not be penetrated by these workers. The NSCC recommends instead the removal of wastes from these areas and their consolidation on undeveloped portions of the Site.

EPA Response

The Agency has discussed the consolidation issue elsewhere in this document and in the ROD. Here the Agency will address the adequacy of the cap and institutional controls in preventing workers from coming into contact with the wastes.

The NSCC's concern is valid. If the institutional controls, which could include zoning by-laws and easements in addition to deed restrictions, cannot be put in place in such a way that the Agency, DEOE, the City of Woburn and the public can rely on them, then the proposed remedial action may not be feasible.

The Agency intends to work with all parties involved to establish adequate legal protection of the cap to prevent the kind of exposures about which the NSCC is concerned. As discussed in the ROD, the Agency will use the type of restrictions mandated by the Resource Conservation and Recovery Act (RCRA) as the model for at Industri-plex.

If such controls are unobtainable or otherwise prove unsatisfactory, the proposed remedial action will have to be reconsidered and alternatives, such as complete consolidation or removal, re-evaluated. Any changes in the planned remedial actions for the Site will be discussed with all parties and the changes will be described in a supplemental ROD issued by the Regional Administrator.

29. The North Suburban Chamber ofCommerce (NSCC) is concerned that the action levels (allowable levels) proposed in the FS and accepted by the Agency will not protect the public health.

EPA Response

The Agency disagrees with the NSCC on this issue. The Endangerment Assessment in the FS calculated the limiting effect doses (LED's) based on the EPA drinking water standards for organic lead and chromium. These drinking water standards have been reviewed and endorsed by the National Academy of Sciences. Using these LED's, the FS postulated exposure scenarios by which the public might come in contact with the wastes. The conclusions of this process were reviewed by the Agency and by the Department of Health and Human Services Agency for Toxic Substances and Disease Registry (ATSDR). Both found the levels protective of the public health. ATSDR, in fact, concluded that, for an industrial park, the levels could be ten times higher and remain protective of the public health. The Agency decided to accept the more protective levels proposed in the FS based on the uncertainty of the future use of the Site.

Public Health and Safety Issues

30. A community member suggested that area residents be checked periodically for possible health impacts on a regular and continuing basis.

EPA Response:

The questions of potential health impacts and, as an outgrowth of this concern, a request for a community health monitoring program, are very common and legitimate issues raised during the course of any Superfund investigation. The need for such a study is evaluated on a Site by Site basis. In this regard the EPA requests from the appropriate state public health agency and the Department of Health and Human Services' Agency for Toxic Substances and Disease Registry (ATSDR) assistance in the determination of need. EPA provides its knowledge of Site conditions and environmental expertise while the health agencies provide the expertise about the potential for health impacts resulting from the Site.

Early in the Site investigation, EPA worked closely with the Massachusetts Department of Public Health (DPH) and the Federal Center for Disease Control (CDC) to evaluate the need for public health assessment as a result of possible exposure from the Industri-plex 128 site. The conclusion was that the nature of the waste and Site characteristics made it unlikely that the surrounding community was at risk from the Site. Subsequent on- and off-site data and the Endangerment Assessment conducted during the Feasibility Study support the DPH and CDC conclusions. As a result, the Agency does not believe that such a monitoring program is either necessary or warranted.

31. A representative of the group For a Cleaner Environment (FACE) questioned: a) the ability of access roads to handle the proposed high traffic volume if trucks were to operate during the day; b) the safety of the heavy trucks carrying soil cover over unstable ground during late evening hours; and c) whether measures would be taken to protect against equipment vandalism in isolated parts of the Site.

EPA Response:

The questions FACE raised are all questions which are most appropriately resolved during the Remedial Design (RD) process. It is well known that the existing road system is at peak capacity during certain portions of the day. This fact has a significant impact on the ability to implement most of the remedial actions considered in the Feasibility Study (FS). The selected remedial action seeks to minimize any additional impacts on the overworked road system by minimizing the amount of off-site fill material necessary to adequately cover the areas requiring remedial action. When compared to the majority of other alternatives, the recommended remedial action requires relatively small quantities of off-site material. While it is premature to provide a definitive answer to the first part of this question until the RD process has accurately identified specific areas and amounts of fill required for those areas, several options which are being considered are: trucking during off peak hours only, bringing fill in only on weekends, bringing fill on-site using rail cars, or constructing special access roads to bring materials on site.

Again, as part of the RD process, steps involving standard and prudent engineering practices will be incorporated into the design to ensure that the remedial action is implemented efficiently and safely. There are a number of techniques available to provide a stable platform for heavy equipment to work from. For example, techniques such as the placement of soil stabilization fabrics followed by fill material can create a stable base. Another technique would involve the placement of cover material on a stable base, trucking material over the cover and stable base to the interface, depositing the fill and, working from the already placed cover, slowly extending the cover using the already placed cover as a base.

In response to the last part of the question, most of the monitoring equipment will not be permanently located in the field but instead brought into the field by the personnel performing the sampling. For those monitoring points (i.e., monitoring wells) which permanently remain on-site, techniques involving construction of protective housings are usually enough to protect the equipment.

The Agency would like to conclude its response to this question by noting that questions similar to the one above will be discussed in more detail with the public as the RD proceeds. The Agency is committed to implementing the necessary remedial actions while minimizing adverse impacts to the surrounding community. It believes that this goal is best reached by substantial interaction with the affected community through a community relations plan.

32. A community resident requested that, given the presence of toxic chemicals in the area, EPA consider how to protect the public from acts of terrorism and sabotage.

EPA Response:

EPA, whenever it becomes involved at a hazardous waste Site, places the protection of the public health, welfare and environment from any sudden releases from the Site as its highest priority. The potential for a sudden release from the site which poses an imminent and substantial threat to the public health, welfare and environment usually results from the deteriorating conditions of barrels, lagoons or tanks as the result of vandalism, not acts of terrorism or sabotage. Site conditions at the Industri-plex 128 site do not indicate that the potential for a sudden release is very high and, as a result, the Agency feels that special steps to address these issues are not necessary. As Site conditions change during the remedial action the Agency will take the necessary steps to ensure that a sudden release does not occur, irrespective of the cause.

Site Closure and Post-Closure Activities

33. The Industri-plex CAC, the North Suburban Chamber of Commerce, and a few residents raised several questions regarding planning and preparation for Site closure and post-closure activities: a) How and by whom will it be determined that remedial action is completed? b) Will a certificate of compliance, or similar document, be issued to affected property owners? c) What agency will oversee Site closure? d) What are the procedures and legal bases for monitoring and enforcing compliance with any restrictions that may be in place? e) What will be the procedure for alerting the public to potential danger from disturbing covered areas? (The CAC suggested that the Federal government acquire sealed Site areas and turn the title over to the City of Woburn.)

EPA Response:

a) It is the responsibility of the United States Environmental Protection Agency (EPA) to ensure that the remedial actions undertaken at a CERCLA site are properly designed, effectively implemented and remain protective of the public health, welfare and environment. Once a Record of Decision (ROD) has been signed by the Regional Administrator, the Army Corps of Engineers (ACE) typically oversees the remedial design and construction process, ensuring that it is completed to specifications. As part of the CERCLA requirements, the Commonwealth of Massachusetts agrees to ensure that the remedial action is properly operated and maintained.

b) The use of institutional controls are an integral part of the remedial action to ensure that the remedial action is not inadvertently disturbed and remains effective. While the general form of these institutional controls will follow those required under the Resource Conservation and Recovery Act (RCRA) it is premature to specifically state what exact form of post-closure restrictions will be required for property owners at the Site. However, one method would be through a court enforced Consent Decree.

c) As noted in the answer to Part a, CERCLA requires that the Commonwealth of Massachusetts be responsible for assuring that proper operation and maintenance (O&M) is undertaken at the Site. CERCLA does not specifically require that the Commonwealth pay for or physically undertake the O&M responsibilities themselves, only that they are properly and effectively implemented. As a result, the Commonwealth may utilize whatever mechanism it deems appropriate to provide that degree of assurance to the EPA. Typically, a state may, through a Consent Decree with a responsible party, require the party to pay for and implement the O&M, or may develop an agreement with a local community or existing property owner. Presently, at this Site the agencies are negotiating with a number of parties on this as well as a number of other issues.

d) There are a number of alternatives available to the federal and state agencies to ensure that the remedial action continues to be effective. One such alternative is a court enforced Consent Decree between the agencies and property owner or responsible parties. It is premature to indicate what the final form of effective controls will be.

e) Currently there is no adequate answer to this question, however, the Agency believes that the contaminated soils (not Hide Deposits) can be disturbed in a carefully controlled manner so as not to pose any potential adverse impact to the public health, welfare and environment. These procedures will be developed as part of the Remedial Design process, at which time the potential exposure/health impacts will be detailed. As these procedures evolve there will be substantial opportunity for public input.

34. The Mystic River Watershed Association requested that EPA and DEQE not label the fenced-off hazardous waste areas of the Site "conservation land" because this would be misleading.

EPA Response:

The EPA and DEQE presently have no plans which would label the property as "conservation land."

35. A community member requested that future development of the Site be forbidden in the areas of hide deposits (in an effort to mitigate odors) and contaminated soils (in an effort to control contaminated dust). In the event that development is permitted in the areas of contaminated soil, the resident requested that the "track record" of the developer as well as monitoring and enforcement procedures be considered carefully before development is allowed.

EPA Response:

The Agency believes that the citizen's request that no future Site development be permitted is unnecessary and not warranted. The Agency believes that portions of the Site may be developed in some limited fashion so that the effectiveness of the implemented remedial action is not compromised. The Agency proposes to control future Site development through the use of institutional controls. These institutional controls are designed to prevent the unauthorized disturbance of the remedial action.

The Agency is aware of the community's concern about the potential release of odors and contaminants and would modify any development proposal to ensure that there were no release of odors or other contaminants during the development.

A process to ensure consistency and public input prior to any permission being granted will be developed as part of the Remedial Design Process.

36. The Industri-plex CAC suggested that Stauffer's fifteen-year monitoring plan include a regulatory process for reviewing proposals to alter the Site. The CAC proposed that DEQE file a monitoring program with appropriate officials and agencies five years before the end of Stauffer's fifteen year monitoring period. The CAC proposed that the program require the filing of annual reports by the monitoring party to provide details on maintenance, security, and landowner alterations at the Site.

EPA Response:

The CAC comments are appropriate and will be incorporated in detail as part of the Remedial Design process.

37. A citizen requested that an "odor and particulate notification plan," including provisions for emergency evacuation and voluntary relocation, be in place during cleanup activities and during any possible future development activity at the Site.

EPA Response:

The Agency believes that such a plan is unnecessary and unwarranted. Techniques to minimize and contain any release or threat of release during and after the construction of the remedial action shall be incorporated as part of the remedial design. The Agency will continue to work with the Citizen's Advisory Committee, community leaders, representatives of business and the general public to ensure that their concerns are adequately addressed during the remedial design phase.

38. The Industri-plex CAC stated that it wishes to review specific remedial design plans and any plans for monitoring the Site during the fifteen-year period for which Stauffer has monitoring responsibility.

EPA Response:

The agencies have welcomed the past involvement of the Industri-plex CAC. They have been continually impressed with the CAC's degree of professionalism, dedication to the task and positive suggestions for improvement in the products produced. The agencies look forward to continued interaction with the CAC and public. The agencies believe that the CAC will have ample time to review and have input into all aspects of the remedial design process, including the fifteen year monitoring program.

39. The Industri-plex CAC requested that the land area on which the piles are currently located not be available for development, for other land uses or for any type of alteration once the remedial action is completed.

EPA Response

The Agency is cognizant of the CAC's concern that future Site activities will adversely impact the implemented remedial actions . The Agency agrees with the basic intent of the CAC's proposal but not the manner in which to accomplish the goal.

Subpart G, Closure and Post-Closure of the Resource Conservation and Recovery Act, will govern how the Site is to be maintained once the remedial action is completed. Specifically, § 264.117(c) states that post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other components of any containment system unless the Regional Administrator finds that the disturbance is necessary to the proposed use of the property and will not increase the potential hazard to human health or the environment. As can be seen from the above section, RCRA requires careful consideration by the Regional Administrator prior to allowing modification of the remedial action. Presently the Agency can see conditions under which certain Site development would be permitted under specific guidelines and controls. A draft of these guidelines and conditions will be developed and included as part of the remedial design process.

Again, as part of the RD process, steps involving standard and prudent engineering practices will be incorporated into the design to ensure that the remedial action is implemented efficiently and safely. There are a number of techniques available to provide a stable platform for heavy equipment to work from. For example, techniques such as the placement of soil stabilization fabrics followed by fill material can create a stable base. Another technique would involve the placement of cover material on a stable base, trucking material over the cover and stable base to the interface, depositing the fill and, working from the already placed cover, slowly extending the cover using the already placed cover as a base.

Public Participation Process and Miscellaneous Concerns

40. The CAC asked EPA and DEOE to legitimize the CAC process by formally incorporating it into the administration of both the Federal and Massachusetts Superfund programs.

EPA Response:

The formation of the Citizens Advisory Committee (CAC) was done under the Massachusetts Environmental Policy Act (MEPA) as a method for citizens to advise the Secretary of Environmental Affairs, who in turn submits his or her concern to the DEOE. The DEOE and EPA believe that the CAC under MEPA has been and will continue to be an effective forum for citizens to have significant input into the process.

The EPA community relations plan, while recognizing the usefulness of specialized groups, such as the CAC, prefers to solicit public input from all facets of the community and not limit itself to the formal designation of one particular group. As a practical matter, the DEQE and EPA intend to use the CAC as a primary forum to hold informal discussions with the general public in addition to the formal public hearing process.

41. Boston Edison Company, which has two major transmission rights-of-way (ROW) on the Site, is concerned that the proposed remedial actions will have adverse effects on the operation and maintenance (O&M) of ROWs and the reliability of electric service in the area. The Company requested specifically that: a) provisions be taken for proper O&M of ROWs in areas where soil has been covered; b) existing utility poles be replaced with those that can withstand the effects of contaminated soil; c) the remedial action plan take into account all requirements of the National Electrical Safety Code and provide financially for maintaining utility services; and d) a specification of work plan practices for access to and maintenance of transmission structures be provided to the company.

The Company was concerned that the FS only considered a 250-acre area (Part A in the May 1982 RI Plan). It was Boston Edison's understanding that the Industri-plex Superfund Site included both Areas A and B.

EPA Response:

The EPA and the Massachusetts Department of Environmental Quality Engineering (DEQE) have been responsive to the particular needs of Boston Edison Company as a public utility company. Pending completion of the Remedial Design, the procedures currently in place will remain in effect.

The agencies expect to work closely with Boston Edison during the remedial design phase to ensure that the respective organizations are able to implement the necessary plans with a minimal impact on either's project. The agencies will make every effort to allow Boston Edison easy access to its ROWs for the purposes of routine operation and maintenance.

Boston Edison is correct in stating that the RI/FS only addressed in detail areas specifically identified in the May 1982 Consent Order with Stauffer Chemical Company. The Phase II study did identify areas outside the original 250 acres, however, not in the same level of detail as for those areas within the 250 acres. The Agency intends, with the signing of the Record of Decision (ROD), to address all areas of contamination associated with the original Site, irrespective of the original Consent Order. The exact size of this additional area is not known at present; however, during the initial phases of the Remedial Design process additional soils investigations will be conducted not only to better define those areas outside the initial scope of the Consent Order but the developed areas within the original area as well. The Agency believes that these additional areas, including ROW #9, can easily be incorporated into and made a part of the Remedial Design process.

42. The North Suburban Chamber of Commerce requested a thirty day extension of the public comment period (the original public comment period was from May 14 to July 1, 1985), from August 1, 1985, to August 31, 1985, in order to identify property owners at the Site and encourage them to comment.

EPA Response:

The Agency extended the close of the public comment peiod from July 1, 1985, to August 1, 1985. It respectfully declined to extend it until August 31, 1985.

43. State Representatives Geoffrey Beckwith and Nicholas Paleologos and U.S. Representative Edward Markey requested that the public comment period for the proposed remedial action be extended from July 1 to August 1, 1985 so that public groups and individuals would have more time to study Stauffer's proposed cleanup approach.

EPA Response:

The Agency agreed with the State and Federal representatives and increased the length of time for public comment from July 1, 1985 to August 1, 1985.

44. Mayor Rabbitt of Woburn stated that citizens and the administration of Woburn want to be part of the decision-making process at the Site.

EPA Response:

The Agency believes, as a result of the substantial interaction between the city, the Citizens Advisory Committee, ad hoc groups, the general public and the agencies, that the public and City of Woburn have been part of the decision making process. The formal public comment period concluded the first portion of the public's involvement. At the close of this period, the EPA sifted through all the information available to it and made a decision which is not only protective of the public health, welfare and environment, but consistent with applicable or relevant and appropriate federal public health and evironmental requirements as well. This decision is summarized and articulated in the ROD. Once the ROD is signed, the Remedial Design process will begin, and along with it the public's opportunity to have input in the outcome of the Remedial Design.

Comments from Monsanto

Comments by Monsanto Company were entered into the public record at the July 17, 1985 public hearing as part of the formal public hearing process. At this hearing, Monsanto reported that it agreed in general that Stauffer's proposed cleanup adequately, and in some cases more than adequately, addresses the public health and environmental concerns associated with the site. Monsanto Company supports a "reasonable cost-effective remediation of the Site which addresses the safety of the community and the desire that the Site be returned to commercial/industrial use as soon as possible." Monsanto submitted two detailed documents for the record.

45. The objective of Monsanto's first document was to determine the maximum safe concentrations of arsenic, chromium, and lead in the soil which would allow unrestricted use of the restored land in the future.

The findings of Monsanto's study were consistent with the conclusion reached by Stauffer concerning maximum safe soil metals' concentrations. In addition, Monsanto calculated values for an industrial setting which they believed to be protective of the public health, welfare and environment.

EPA Response

EPA believes that this is more a statement than a question and therefore will not respond except to note that the Agency concurs with Monsanto's conclusion.

46. Monsanto's second document presented the company's recommendations for remedial actions to be undertaken at the Industri-plex site. In particular, Monsanto claimed that its remedial action plan would provide:

a. A quicker return of a large portion of the site to commercial and industrial use;
b. A soil cover with an average coverage depth of twelve inches that is both sufficient and practical for isolation of heavy metals;

c. An innovative, cost-effective approach to groundwater cleanup; and

d. A complete long-term solution to the East and West Hide Piles that addresses existing and future surface water problems.

The Agency would note that the document referred to above was an unsolicited Feasibility Study (FS) by Monsanto Chemical Company, a major responsible party at this Site. The Agency would further note that it believes that it has satisfactorily addressed Monsanto's concerns within the body of the ROD. However, a brief answer is summarized below.

a. The objective of any remedial action undertaken at a CERCLA site is to take the necessary remedial responses to be protective of the public health, welfare and environment. While it is not the intent of the Agency to unnecessarily adversely impact abutting property owners, the Agency will not permit personal and private interests to prevent implementation of the most cost-effective long-term remedy for a site. As a result, a quick return of a site to commercial and industrial use is not a criterion against which remedial actions are evaluated.

b. The proposal of a twelve inch cover was rejected for the same reasons that S-6 of the FS was rejected. These reasons are detailed in the ROD document itself, and the reader is referred to the appropriate sections of the ROD.

c. Monsanto's approach to remediate the overall groundwater problem posed by the site has merit; however, for reasons stated in the ROD, the Agency selected an interim groundwater remedy until the resolution of the area-wide problem is resolved. Therefore, Monsanto's proposal is inappropriate for the same reasons that GW-3 and GW-4 are.

d. The proposal for remediation of the odors caused by the hide deposits advanced by Monsanto was not responsive to the actual site conditions; instead it was a more conceptual approach to the problem. Implementation of Monsanto alternative would not be feasible because, like A-2, A-3, and A-4 proposed in the FS, it wished to control odors at the expense of eliminating wetland. The Agency found this approach unacceptable. In addition, Monsanto indicated that substantial reworking of the piles to form one large pile was attractive, stating that the odor release could be dealt with. The Agency believes that there is no effective method to accomplish both tasks at the same time and, as a result, Monsanto's air proposal would create unacceptable quantities of odor emissions.

47. Janpet Associates, owner of land in North Woburn, is concerned that, because of the slow site cleanup process and various impediments to conducting real estate activities on-site, the financial burden to landowners has become substantial.

EPA Response:

The Agency recognizes that, as a result of either being part of the Site or adjacent to it, there may be an economic burden placed on the landowner. The Agency's primary objective at any hazardous waste site is to investigate thoroughly the nature and extent of contamination in order to evaluate and select a remedial action which is protective of the public health and welfare and environment, and which is in compliance with other applicable or relevant and appropriate federal public health and environmental requirements. The Agency will attempt to complete this process as expeditiously as possible; however, the process is long and complicated, especially at a site as large and old as the Industri-plex site. It is not the Agency's intent to cause financial hardship as a result of this process; however, the Agency will not permit personal and private interests to prevent implementation of the most cost-effective, long-term remedy for a site.

Wetlands Issues

In addition to the public health comments received during the initial public comment period, the Agency received three additional comments during the supplemental public comment period on the wetlands.

48. The first was from the Mystic River Watershed Association, Inc., acknowledging receipt and review of the document. The President, Dr. Herbert Meyer, indicated that the reports were adequate.

49. The second comment was from the Woburn Conservation Commission indicating the following comments and concerns:

a. The Conservation Commission believes the report is thorough, technically sound, and clearly written.

b. The Commission will want to review the mitigation plan to compensate for unavoidable impacts on the wetlands, identified as 1.C and 7.

c. The Commission urges EPA to require that the replacement wetlands shall be completed prior to alterations to the existing wetlands west of Commerce Way.

d. The Commission is supportive of the stated intention to take appropriate measures toward the enhancement of the existing wetlands at Industri-plex in order to maximize their wetland values.

EPA Response

a. The Agency concurs with the Conservation Commission assessment of the quality of the reports.

b. The Agency believes that the Woburn Conservation Commission will play an integral and active role in any future dealings relative to wetlands. The Agency further believes that a community should be the primary proponent in the protection of important natural resources such as wetlands.

c. The Agency's decision to control the environmental impact resulting from the East Hide Pile was not to draw and fill the pond and adjacent wetlands. As a result, this comment is no longer pertinent.

50. The final comments were received from Dundee Park Properties, a developer abutting the Site to the north. The bulk of Dundee Park Properties' letter was devoted to the Park's belief that the action was not necessary, infeasible to implement as proposed, and ultimately reduces the amount of developable property east of Commerce Way as a result of the formation of a new replacement wetlands. Specifically, Dundee Park Properties' questions were:

a. Will the proposed creation of the 4.1 acres of wetland on the east side of Commerce Way affect the 12" waterline that Dundee Properties has installed across the Mark-Phillip Trust property? If so, Dundee Park Properties feels it is important that they also be allowed to review the proposed wetland plans being drawn up by Stauffer's consultants as referred to in the report.

b. What costs may be set upon Dundee Park Properties for installation and future maintenance of any south dike flow control device if the 4.1 acre wetland is drained?

EPA Response

a. As a result of the Agency's determination that the pond and its associated wetlands located between the East and West Hide Pile need not be eliminated in order to successfully implement a remedial action, the proposed new wetlands east of Commerce Way will not be built. As a result, Dundee Park Properties' concern relative to their waterline is moot.

b. The costs and the responsibility for assuming these costs have not yet been finalized. These issues will be the subject of upcoming negotiations between the agencies and the responsible parties.

The remainder of the Park's letter was devoted to the Park's opinion as to why the filling of the wetlands and the subsequent taking of uncontaminated developable land was not required. The Agency believes that it is inappropriate to comment on the Park's rationale at this time.

ATTACHMENT A

COMMUNITY RELATIONS ACTIVITIES CONDUCTED AT THE INDUSTRI-PLEX SITE

To ensure that all interested parties are communicating regularly, the EPA has conducted a community relations program at the Industri-plex site. Community relations activities conducted at the Industri-plex site to date include the following:

- EPA prepared a community relations plan, Summer, 1981
- EPA and DEOE attended and participated in meetings of the Industri-plex Citizens' Advisory Committee, ongoing throughout the RI/FS.
- EPA released for public review and comment the draft remedial investigation/feasibility study (RI/FS) on site cleanup alternatives prepared by Stauffer Chemical Company, May, 1985.
- EPA prepared and distributed an information sheet on the draft RI/FS, May, 1985.
- EPA held a public meeting on May 21, 1985 at Woburn High School to describe the RI/FS study and to respond to citizens' questions. Approximately 30 to 35 people attended.
- EPA held a public hearing on July 17, 1985 at Woburn High School to record comments by the public, local and State officials and potentially responsible parties. A transcript of this hearing is available at the main branches of the public libraries in Woburn, Reading, Winchester and Wilmington.
- Following one extension, the public comment period closed on August 1, 1985. It lasted approximately twelve weeks.

APPENDIX B

Statement of Findings

Industri-plex Site

Proposed Remedial Response Action

Soils Contamination

September 1986

In accordance with EPA policy and Executive Orders 11988 and 11990 concerning Floodplains and Wetlands, the following Statement of Finding has been prepared. The Statement of Finding is part of the Record of Decision (ROD) for the Industri-plex Site and further serves to notify the general public and affected agencies that proposed remedial response actions for areas within the Site are in or may potentially affect a base (100 year) floodplain and/or a wetlands. The Statement of Findings includes the following:

1. The reasons why the proposed action must be located in or affect the floodplain or wetlands.

2. A description of significant facts considered in making the decision to locate in or affect the floodplain or wetlands including alternative sites and actions.

3. A statement indicating whether the proposed actions conform to the applicable State or local floodplain protection standards.

4. A description of the steps taken to design or modify the proposed action to minimize potential harm to or within the floodplain or wetlands.

5. A statement indicating how the proposed action affects the natural or beneficial values of the floodplain or wetlands.

The proposed remedial response action at the Site consists of site grading, capping and removal/relocation of contaminated soils and sludges over a seventy acre Site. Portions of the Site contain wetlands which may be impacted by the proposed remedial action - specifically, the wetlands located along the northern border of the Site between the East and West Hide Piles. In addition, two small former waste lagoons, now considered a wetlands, may be impacted. The decision process leading to the selection of this action and a detailed discussion of the action are documented in the ROD. The reason why the proposed action must be located in or affect a floodplain or wetlands is that the area of contamination and contaminant migration pathway is so located. The proposed site grading, capping and removal/relocation actions are not located in a base (100 year) floodplain; however, portions of these actions are located in a wetlands and the actions could affect the same.

The decision to locate in or affect the wetland was based on the fact that a portion of the area of contamination and contamination pathway is so located. The decision to propose remedial action in these areas rather than take no action was based on the public health, welfare and environmental risks associated with this area of contamination. The health risks related to the potential for direct contact of soil contaminated with hazardous substances, i.e. arsenic, chromium and lead, was a significant factor considered in making this decision. The action to grade and cap the Site is considered necessary to protect the public health and environment.

The migration of toxic metals to the wetlands and surface water resulting from precipitation and overland flow has had an adverse impact on the surface water and sediments in the pond. The release or threat of release presents a potential hazard to public health and the aquatic species in the pond. Material will be excavated from the wetlands and pond to eliminate the potential for direct contact and to reduce the potential health risk associated with contaminants in and migrating to these water bodies.

The proposed action at the Site is consistent with the applicable or relevant and appropriate Federal public health and environmental requirements. Proposed actions would also be consistent with State (310 CMR 10.00 Parts I and III) and local wetland standards.

Design and construction activities related to the implementation of the remedial response action proposed will include the best practical measures to minimize potential harm to or within the wetlands. Initial design has considered the need to control adverse impacts; erosion, sediment and contaminant migration, both during construction and resulting from topographic and subsurface drainage changes necessary to the implementation of this action. Control and mitigative measures will be considered in more detail during the final design phase of this action.

Using the best practical measures to control potential adverse impacts will reduce possible harm to the wetlands from siltation and further degradation from contamination. Successful implementation of this action will eliminate the potential risk of surface water and sediment contamination in the wetlands, pond and discharge stream, potential adverse effects on aquatic species and will allow, when coupled with other proposed site remedial actions, for the long term protection of the public health, welfare and enviroment.

APPENDIX C

Statement of Findings

Industri-plex Site

Proposed Remedial Response Action

East Hide Pile

September 1986

In accordance with EPA policy and Executive Orders 11988 and 11990 concerning Floodplains and Wetlands, the following Statement of Finding has been prepared. The Statement of Finding is part of the Record of Decision (ROD) for the Industri-plex Site and further serves to notify the general public and affected agencies that proposed remedial response actions for areas within the Site are in or may potentially affect a base (100 year) floodplain and/or a wetlands. The Statement of Findings includes the following:

1. The reasons why the proposed action must be located in or affect the floodplain or wetlands.

2. A description of significant facts considered in making the decision to locate in or affect the floodplain or wetlands including alternative sites and actions.

3. A statement indicating whether the proposed actions conform to the applicable State or local floodplain protection standards.

4. A description of the steps taken to design or modify the proposed action to minimize potential harm to or within the floodplain or wetlands.

5. A statement indicating how the proposed action affects the natural or beneficial values of the floodplain or wetlands.

The proposed remedial response action at the Site consists of site grading, slope stabilization, installation of an impermeable cap, gas collection system and the construction and operation of a gaseous emission treatment system on the East Hide Pile. The decision process leading to the selection of this action and a detailed discussion of the action are documented in the ROD. The reason why the proposed action must be located in or affect a floodplain or wetlands is that the area of contamination and contaminant migration pathway is so located. The proposed remedial action is not located in a base (100 year) floodplain; however, the area requiring implementation of a remedial action is located in a wetlands and, as a result, any action taken could impact said wetlands.

The decision to locate in or affect the wetland was based on the fact that the area of contamination and contamination pathway is so located. The decision to propose remedial action in these areas rather than take no action was based on the public health, welfare and environmental risks associated with this area of contamination. The health risks related to the potential for direct contact of soil contaminated with hazardous substances, i.e. arsenic, chromium and lead, was a significant factor considered in making this decision. The continued degradation of the pile, including the sloughing of the sides of the pile into the wetlands and the release of a substantial odor impacting the public's welfare were also significant factors considered. The action to grade and cap the Site is considered necessary to protect the public health and environment.

The migration of toxic metals to the wetlands and surface water resulting from precipitation and overland flow, slope stability problems and release of odors has had an adverse impact on the surface water and sediments in the pond. The release or threat of release presents a potential hazard to public health and the aquatic species in the pond. To reduce the potential health risk associated with contaminants in and migrating to the wetlands and pond, sheet piling will be driven at the toe of the slope to stablize the side slopes of the pile; regrading and installation of an impermeable membrane will eliminate the potential for direct contact.

The proposed action at the Site is consistent with the applicable or relevant and appropriate Federal public health and environmental requirements. Proposed actions would also be consistent with State (310 CMR 10.00 Parts I and III) and local wetland standards.

Design and construction activities related to the implementation of the remedial response action proposed will include the best practical measures to minimize potential harm to or within the wetlands. Initial design has considered the need to control adverse impacts; erosion, sediment and contaminant migration, both during construction and resulting from topographic and subsurface drainage changes necessary to the implementation of this action. Control and mitigative measures will be considered in more detail during the final design phase of this action.

Using the best practical measures to control potential adverse impacts will reduce possible harm to the wetlands from siltation and further degradation from contamination. Successful implementation of this action will eliminate the potential risk of surface water and sediment contamination in the wetlands, pond and discharge stream, potential adverse effects on aquatic species and will allow, when coupled with other proposed site remedial actions, for the long term protection of the public health, welfare and enviroment.